THE COLUMBIA BASIN PROJECT

HEARINGS BEFORE THE
COMMITTEE ON IRRIGATION & RECLAMATION
HOUSE OF REPRESENTATIVES
SEVENTY-SECOND CONGRESS
FIRST SESSION ON THE BILL
H. R. 7446

TO PROVIDE FOR THE CONSTRUCTION, OPERATION, AND MAINTENANCE OF THE COLUMBIA BASIN PROJECT IN WASHINGTON, AND FOR OTHER PURPOSES

MAY 25, 27, JUNE 1, 2, 3, AND 13, 1932

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Printed for the use of the Committee on Irrigation and Reclamation

UNITED STATES
GOVERNMENT PRINTING OFFICE
125965 WASHINGTON : 1932

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THE COLUMBIA BASIN PROJECT

WEDNESDAY, MAY 25, 1932

HOUSE OF REPRESENTATIVES,
COMMITTEE ON IRRIGATION AND RECLAMATION
Washington, D. C.

The committee met pursuant to call of the chairman, at 10 o'clock a. m., in the committee room, No. 333 House Office Building, Hon. Robert S. Hall (chairman) presiding.

Present: Representatives Hall, Chairman, Cross, Gasque, Fulbright, Chavez, Miller, Overton, Martin, Smith, Leavitt, Swing, Arentz, Butler, and Loofbourow.

The CHAIRMAN. The committee will be in order. We have met this morning to consider the bill (H. R. 7446) to provide for the construction, operation, and maintenance of the Columbia Basin project in Washington, and for other purposes, which was introduced on January 11, last by Congressman Hill, of Washington. At this point, the reporter will insert a copy of the bill for the information of the committee.

(The bill referred to is here printed in full as follows:)

[H. R. 7446 Seventy-second Congress, first session]

A BILL to provide for the construction, operation, and maintenance of the Columbia Basin project in Washington, and for other purposes

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That for the purpose of conserving the water supply, controlling floods, improving navigation, and regulating the flow of the Columbia River, providing for the storage and delivery of water for the irrigation of lands in what is hereby designated as the Columbia Basin project, embracing such lands in the eastern part of the State of Washington as may be found feasible of irrigation; and for the generation of electrical energy as a means of making the project hereby authorized a self-supporting and financially solvent undertaking, the Secretary of the Interior is hereby authorized as follows:

(1) To construct, operate, and maintain a dam of the greatest practical and necessary height and incidental works in the Columbia River at Grand Coulee in the State of Washington; (2) to construct, equip, operate, and maintain at said dam a complete plant and incidental structures suitable for the fullest development of electrical energy from the water discharged from the reservoir created by said dam; and (3) to construct, operate and maintain such diversion dams and storage reservoir, pumping plants, canals, laterals, and other incidental facilities as may be found necessary or advisable for the diversion, storage, and delivery of water from said river for the irrigation of lands embraced within or tributary to said Columbia Basin project. The works last described may be constructed in such divisions or units as the Secretary of the Interior may find most feasible, and at such times, after the completion of said dam at Grand Coulee, and in such sequence, as the agricultural and economic conditions and the general welfare of the country may justify. The Secretary of the Interior shall determine the part of such costs of pumping plant, dams, canals, laterals, and other necessary works in connection with the irrigation of the lands, that is just and equitable and necessary to the success of such irrigation project, which shall be paid from power revenues.

The works for irrigation purposes last described shall be constructed and the cost thereof shall be repaid to the United States in accordance with the reclamation law.

SEC. 2. (a) There is hereby established a special fund to be known as the Columbia Basin fund (hereinafter referred to as the fund), to be available, as hereafter provided, only for carrying out the provisions of this act. All revenue received in carrying out the provisions of this act shall be paid into and expenditures shall be made out of the fund under the direction of the Secretary of the Interior.

(b) The Secretary of the Treasury is authorized to advance to the fund, from time to time, and within the appropriations therefor, such amounts as the Secretary of the Interior deems necessary for carrying out the provisions of this act, except that the aggregate amount of such advances shall not exceed the sum of ($260,000,000 per revised bill).

(c) The Secretary of the Interior shall determine the proportion of cost which properly should be charged to flood control, which amount is not to be reimbursed to the fund.

(d) Interest at the rate of 4 per centum per annum accruing during the year upon the amounts so advanced for construction and operation of said dam in the Columbia River at Grand Coulee, power plant and appurtenant structures and remaining unpaid shall be paid annually out of the fund.

(e) Moneys in the fund advanced under subdivision (b) shall be available only for expenditures for construction and the payment of interest, during construction, to the extent required, upon the amounts so advanced. No expenditures out of the fund shall be made for operation and maintenance except from appropriations therefor.

(f) The Secretary of the Treasury shall charge the fund as of June 30 in each year with such amount as may be necessary for the payment of interest on advances made under subdivision (b) at the rate of 4 per centum per annum accrued during the year upon the amounts so advanced and remaining unpaid.

(g) The Secretary of the Interior shall certify to the Secretary of the Treasury, at the close of each fiscal year, the amount of money in the fund in excess of the amount necessary for construction, operation, and maintenance, and payment of interest. Upon receipt of each such certificate the Secretary of the Treasury is authorized and directed to charge the fund with the amount so certified as repayment of the advances made under subdivision (b), which amount shall be covered into the Treasury to the credit of miscellaneous receipts.

SEC. 3. There is hereby authorized to be appropriated from time to time out of any money in the Treasury not otherwise appropriated, such sums of money as may be necessary to carry out the purposes of this act, not exceeding in the aggregate ($260,000,000 per revised bill).

SEC. 4. Before any money is appropriated for the construction of said dam in the Columbia River at Grand Coulee and/or power plant, and before any construction work thereon is done or contracted for, the Secretary of the Interior shall make provision for revenues by contract, in accordance with the provisions of this act, adequate in his judgment to insure payment of all expenses of operation and maintenance of said works incurred by the United States and for the repayment, within fifty years from the date of the completion of said works, of all amounts advanced to the fund under subdivision (b) of section 2 for such works, except for the amount allocated to flood control, together with such interest thereon as is made reimbursable under this act.

SEC. 5. Before any money is appropriated for the construction of diversion dams, pumping plants, canals, laterals, or other facilities for the irrigation of lands embraced within or tributary to said project, and before any construction work thereon is done or contracted for, the Secretary of the Interior shall make provision for revenues by contract or otherwise adequate in his judgment to insure repayment of all expenses of construction, operation, and maintenance of said works in the manner provided by the reclamation law. Such works may be constructed by divisions or units as specified in section 1 hereof, and contracts for repayment therefor may be made accordingly.

SEC. 6. That the Secretary of the Interior is hereby authorized, under such general regulations as he may prescribe, to contract for the sale of the stored

water in said reservoir and for the delivery thereof at such points as may be agreed upon, for irrigation and domestic uses, and for the generation of electrical energy and delivery thereof (at the switchboard) to States, municipal corporations, political subdivisions, associations, and private corporations, of electrical energy generated at said dam upon charges that will provide revenue which, in addition to other revenues accruing under the reclamation law and under this act, will, in his judgment, cover all expenses of operation and maintenance incurred by the United States on account of works constructed under this act, except for the amount allocated to flood control, and the payments to the United States as required by sections 4 and 5 hereof. Contracts respecting water for irrigation and domestic uses shall be for permanent service. No person, organization, or body of whatsoever kind shall have or be entitled to have the use for any purpose of the water stored as aforesaid except by contract made as herein stated.

After the repayments to the United States of all money advanced with such interest as is required by this act, charges shall be on such basis and may be fixed by law or regulation and the revenues derived therefrom shall be disposed of as may hereafter be prescribed by Congress.

General and uniform regulations shall be prescribed by the said Secretary for the awarding of contracts for the sale and delivery of electrical energy, and for renewals under subdivision (b) of this section, and in making such contracts the following shall govern:

(a) No contract for electrical energy or for generation of electrical energy shall be of longer duration than 50 years from the date at which such energy is ready for delivery.

(b) Contracts for the use of water and necessary privileges for the generation and distribution of hydroelectric energy or for the sale and delivery of electrical energy shall be made with responsible applicants therefor who will pay the price fixed by the Secretary of the Interior, with a view to meeting the revenue requirements herein provided for. In case of conflicting applications, if any, such conflicts shall be resolved by the said Secretary, after hearing, with due regard to the public interest, and in conformity with the policy expressed in the Federal water power act as to conflicting applications for permits and licenses, except that preference to applicants for the use of water and appurtenant works and privileges necessary for the generation and distribution of hydroelectric energy, or for the delivery thereof (at the switchboard of a hydroelectric plant) shall be given; first to States for the generation or purchase of electric energy for use only within their respective borders; second, to municipalities and other political subdivisions primarily for their own use and purposes incidental thereto; and, third, to associations, corporations, and individuals: *Provided, however*, That no application of a municipality or a political subdivision for allocation of electricity shall be denied or another application in conflict therewith be granted on the ground that the bond issue of such municipality, or political subdivision necessary to enable the applicant to utilize the electrical energy applied for has not been authorized or marketed, until after a reasonable time, to be determined by the said Secretary, has been given to such applicant to have such bond issue authorized and marketed.

The rights covered by such preference shall be contracted for within six months after notice by the Secretary of the Interior, and the energy or privilege shall be paid for on the same terms and conditions as may be provided for in other similar contracts made by said Secretary.

SEC. 7. This act shall be deemed a supplement to the reclamation law, which said reclamation law shall govern the construction, operation, and management of the irrigation works herein authorized, except as otherwise herein specifically provided.

SEC. 8. The use is hereby authorized of such public and reserved lands of the United States as may be necessary or convenient for the construction, operation, and maintenance of main transmission lines to transmit said electrical energy.

SEC. 9. The Secretary of the Interior shall prescribe and enforce rules and regulations conforming with the requirements of the Federal water power act, so far as applicable, respecting maintenance of works in condition of repair adequate for their efficient operation, maintenance of a system of accounting, control of rates and service in the absence of State regulation or interstate agreement, valuation for rate-making purposes, transfers of contracts, contracts extending beyond the lease period, expropriation of excessive profits, recapture and/or emergency use by the United States of property of lessees, and

penalties for enforcing regulations made under this act or penalizing failure to comply with such regulations or with the provisions of this act. He shall also conform with other provisions of the Federal water power act and of the rules and regulations of the Federal Power Commission, which have been devised or which may be hereafter devised, for the protection of the investor and consumer.

Collections from licensees under the Federal water power act resulting from assessments made pursuant to section 10 (f) of that act shall be covered into the fund and be available for transfer and expenditure in the same manner as other accruals to the fund.

SEC. 10. Nothng herein shall be construed as interfering with such rights as the States now have either to the waters within their borders or to adopt such policies and enact such laws as they may deem necessary with respect to the appropriation, control, and use of waters within their borders.

SEC. 11. "Political subdivision" or "political subdivisions" as used in this act shall be understood to include any State, irrigation or other district, municipality, or other governmental organization.

"Reclamation law" as used in this act shall be understood to mean that certain act of the Congress of the United States approved June 17, 1902, entitled "An 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," and the acts amendatory thereof and supplemental thereto.

"Maintenance" as used herein shall be deemed to include in each instance provision for keeping the works in good operating condition.

"The Federal water power act" as used in this act shall be understood to mean that certain act of Congress of the United States approved June 10, 1920, entitled "An act to create a Federal Power Commission; to provide for the improvement of navigation; the development of water power; the use of the public lands in relation thereto; and to repeal section 18 of the river and harbor appropriation act, approved August 8, 1917, and for other purposes," and the acts amendatory thereof and supplemental thereto.

SEC. 12. The Secretary of the Interior is authorized to promulgate and enforce any rules and regulations necessary to effectuate the purposes of this act.

SEC. 13. The short title of this act shall be "Columbia Basin project act."

The CHAIRMAN. We are very delighted to have Senator Jones, of Washington, and Congressmen Hill and Summers of the same State, with us at the beginning of the hearings on this bill. It will be the policy of the chairman to leave this matter largely in the direction of these gentlemen to present their information to the committee bearing upon this problem. Judge Hill, I will call upon you first and then Doctor Summers, and I know we will have the statement of Senator Jones as quickly as you can arrange it. I think he would like to return to his committee work.

STATEMENT OF HON. SAMUEL B. HILL, A REPRESENTATIVE FROM THE STATE OF WASHINGTON

Mr. HILL. You have a copy of the bill before you.

The CHAIRMAN. Yes.

Mr. HILL. I would like to present for the record at this time a letter of the Secretary of the Interior to the chairman of this committee accompanied by a memorandum upon which the letter is based, from Dr. Elwood Mead, Commissioner of Reclamation, and would ask that the letter with memorandum attached be made part of the record.

The CHAIRMAN. Very well.

(The letter referred to is here printed in full as follows.)

DEPARTMENT OF THE INTERIOR,
Washington, May 20, 1932.

Hon. ROBERT S. HALL,
Chairman Committee on Irrigation and Reclamation,
House of Representatives.

MY DEAR MR. CHAIRMAN: I have your request for my report on H. R. 7446, a bill to provide for the construction, operation, and maintenance of the Columbia Basin project in Washington, and for other purposes.

Examination of the reports of the Bureau of Reclamation and of the Chief of Engineers of the War Department leads without difficulty to the conclusion not only that the construction of the Columbia Basin project is highly desirable, but it is both physically and financially feasible under the plan contemplated by the proposed legislation for the development of power and for the utilization of power profits—after repaying the cost of power development—in amortizing, together with water user repayments, the cost of the irrigation developments in such units and at such times as economic conditions may justify.

Nevertheless, I must recommend that the proposed legislation await a later and healthier condition of the Treasury. The Chief Executive and the Congress are grappling with a deficit of $900,000,000 for the fiscal year 1931 and a prospective deficit of $2,500,000,000 for the fiscal year 1932 and $1,700,000,000 for the fiscal year 1933; and measures that would normally be considered of a drastic character are now being presented for the purpose of preventing deficits in succeeding years.

I assume that the report of the Chief of Engineers of the War Department is before you. For your information, I am inclosing a report of the Bureau of Reclamation on this project, together with a memorandum submitted to me by the Commissioner of Reclamation with reference to the instant bill, H. R. 7446. He proposes certain amendments to the measure. I believe that when and if the bill is enacted these amendments should be included.

For the above reasons I can not recommend favorable action on this bill at this time.

Very truly yours,

RAY LYMAN WILBUR.

DEPARTMENT OF THE INTERIOR,
BUREAU OF RECLAMATION,
Washington, May 16, 1932.

Memorandum for the Secretary.

Attached letter of January 14 from Hon. Robt. S. Hall, chairman Committee on Irrigation and Reclamation, House of Representatives, requests report upon H. R. 7446, a bill to provide for the construction, operation, and maintenance of the Columbia basin project in Washington, and for other purposes.

This bill is substantially the same as S. 2860, upon which memorandum was submitted March 30, 1932, and on which the Secretary made report to the Senate committee on May 11.

The bill authorizes the construction, operation, and maintenance of the Columbia Basin project in Washington, the purpose of which is to conserve the waters of the Columbia River and make them available for the development of hydroelectric power and for the ultimate irrigation of 1,200,000 acres of fine agricultural land to be developed only as demand and economic conditions justify. This is the largest and finest compact body of land feasible of irrigation remaining undeveloped in the United States. The possibilities of this area under irrigation have been fully demonstrated by what has been accomplished in the Yakima and Wenatchee Valleys on the west and at Lewiston and Coeur d'Alene on the east.

As a conservation measure this ranks among the greatest yet attempted in this country. The water of the Columbia River is the most valuable resource of the Northwest. It has the immeasurable value of being permanent, of being made the basis of a great industrial and agricultural development. The average annual discharge at the mouth of the Columbia is 180,000,000 acre-feet, or enough to irrigate all the arid land irrigated or irrigable in the United States. That is far more than can be reclaimed from the river because suitable land

is lacking, but it insures for all the land to be irrigated from this project the first requisite of successful irrigation, and that is an ample water supply for all years and all seasons of the year.

The Columbia is the second largest stream of the United States, being exceeded in size only by the Mississippi. Its annual discharge at the point of diversion fixed in this bill is twice that of the combined flow of the Sacramento and San Joaquin Rivers in California, and three times that of the Colorado River at Hoover Dam. To utilize this water for irrigation and the generation of hydro-electric power it is proposed to construct a dam across the Columbia River at the head of the Grand Coulee, which will raise the water surface of the river 350 feet and create a reservoir 150 miles long, extending to the international boundary; to install a power plant at the dam having a generating capacity of 1,500,000 kilowatts, and to construct distributing works for irrigation to supply water to 1,200,000 acres. The river at Grand Coulee has a minimum annual flow of 55,000,000 acre-feet, or enough to irrigate ten times the amount of land which can be reached by the proposed works.

The estimated cost of construction of the project is as follows:

Columbia River Dam	$125, 750, 000
Columbia River Power Plant	42, 616, 000
Subtotal	168, 366, 000
Interest during construction on above	17, 524, 000
Subtotal	185, 890, 000
Irrigation development for 1,200,000 acres	208, 265, 000
Total cost	394, 155, 000

The maximum estimated investment in the combined power and irrigation project up to the time when power revenues are sufficient to reduce the investment is $260,000,000. Therefore the maximum amount of money which the bill authorizes to be appropriated from the United States Treasury is limited to $260,000,000.

Eight hundred thousand kilowatts of firm continuous power, equivalent to 7,000,000,000 kilowatt-hours of energy annually, would be available for sale commerlially and in addition there would be a large amount of secondary power which would be utilized for irrigation pumping. Studies of the cost of competitive power from other sources indicate that the firm energy could be sold at from 2 to 2.25 mills per kilowatt-hour.

The economic feasibility of the project depends in large measure upon the ability of the power market to absorb the power. During the past decade the power requirements in the territory within economic transmission distance have increased at the rate of 9.5 per cent compounded annually. It is estimated that the power requirements will continue to increase in the future as they have in the past, but at a gradually reducing rate of increase, starting with 8 per cent in 1930 and gradually decreasing to 4 per cent in 1960. This is a somewhat more conservative estimate than the one in the report on the Columbia River by the Corps of Engineers of the United States Army which assumed a rate of increase of 9.5 per cent in 1930 and gradually decreasing to 4.75 per cent in 1960.

The amount of energy generated in the market area in 1930 was approximately 4,000,000,000 kilowatt-hours. If the power requirements increase as predicted, the amount of energy generated in 1940 will be approximately 8,000,000,000 kilowatt-hours and by 1955 this will have increased to over 20,000,000,000 kilowatt-hours. The increase in power requirements up to the time that Grand Coulee power first becomes available would have to be supplied from other sources and during this period most, if not all, of the power from new developments which the various power companies and municipalities have under construction would be utilized. Power from the proposed Columbia River development could not be made available before 1940 at the earliest, and from then until 1955 the amount of energy generated is expected to increase 12,000,000,000 kilowatt-hours. The Columbia River power plant would produce 7,000,000,000 kilowatt-hours of firm energy, or sufficient to supply a little more than one-half of the expected increase, during the 15-year period following completion of the dam. With full cooperation on the part of the power companies and municipalities it should be possible for the power to be absorbed

in from 15 to 20 years after completion of the dam, and it might be absorbed in a considerably less time if the requirements for power increase as predicted.

The rapidity with which the power is absorbed has an important bearing on the cost of production. During the early part of the absorption period the revenues from power will be insufficient to meet the annual charges and deficits will be incurred. The fore rapidly the power is absorbed the smaller will be the amount of these deficits and consequently the lower the cost of the power.

The cost of the Columbia River dam and power plant, estimated at $185,890.000, is to be repaid with interest at 4 per cent within 50 years from revenues derived from the sale of power. The cost of the irrigation works, estimated at $208,265,000, is to be repaid without interest, one-half from surplus power revenues and the remainder is to be repaid as construction charges by the landowners, in the manner provided in the reclamation law. Irrigation development is to be deferred until the Columbia River dam and power plant are completed, and it would then proceed by units as justified by the demand for additional land by the settlers and by the successful development of previous units.

The development of the Columbia Basin project involves the conservation of a part of the great natural resources of the State of Washington, and the feasibility of the project depends upon the absorption of the power within a reasonable time after completion of the dam. Therefore, the undertaking depends largely upon the attitude of the State, municipalities and power companies toward the absorption of the power. If these agencies will all cooperate to the fullest extent and arrange their individual power development programs so as to absorb the output of the proposed Columbia River power plant in the shortest possible time, the project will be successful.

The bill, H. R. 7446, which has been introduced to provide for the construction, operation, and maintenance of the Columbia Basin project, provides that no construction work on the dam and power plant shall be done or contracted for until contracts have been made for the sale of power which will insure adequate revenues to provide for repayment of the cost of the dam and power plant, including interest at 4 per cent per annum, within 50 years. The bill also provides that no work on the irrigation features is to be done or contracted for until provision has been made for revenues adequate to insure repayment of all operation and maintenance expense and not less than one-half of the cost of these features, in accordance with the reclamation law. The balance of the construction cost of the irrigation works shall be repaid from power revenues, which must be adequate to pay the part of the cost so allocated (in addition to the cost of the Columbia River dam and power plant, with interest) before the irrigation works can be built.

These requirements of the bill remove all risk of loss in so far as the Government is concerned, and give assurance that the project will be a self-supporting and financially solvent undertaking.

Additional reports received and studies made since the introduction of the bill justify the suggestion of several additions to and amendments of the bill. The amendments proposed are designed to clarify certain features which might otherwise be somewhat uncertain. The bill in general outline follows that of the Boulder Canyon Project Act, the language of which has been retained, except where modified to meet special conditions and to clarify provisions which gave rise to difficulty in interpretation and application. It appears that the various changes proposed can be best incorporated by rewriting of the bill. It is, therefore, recommended that in lieu of the bill as introduced the following be substituted:

"*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That for the purpose of conserving the water supply, controlling floods, improving navigation, and regulating the flow of the Columbia River, providing for the storage and delivery of water for the irrigation of lands in what is hereby designated as the Columbia Basin project, embracing such lands in the eastern part of the State of Washington as may be found feasible of irrigation; and for the generation of electrical energy as a means of making the project hereby authorized a self-supporting and financially solvent undertaking, the Secretary of the Interior is hereby authorized as follows:

"SEC. (*a*) To construct, operate, and maintain on the Columbia River near the head of Grand Coulee, in the State of Washington, a dam, power plant, and incidental works for the fullest practicable development of electrical energy with water released at said dam, such power to be sold at said dam.

"(*b*) To make at said dam on the Columbia River, at the time of its construction, suitable provision for the future installation of navigation facilities.

"(c) To construct, operate, and maintain a pumping plant to lift water from the Columbia River, together with canals, dams, laterals, drains, and other power and pumping plants, transmission lines, and such other works as maybe needed for the diversion, carriage, control, delivery, and disposal of water for the irrigation of lands embraced within said project.

"The works described in subsection (c) may be constructed in such divisions or units as the Secretary of the Interior may find most feasible, and at such times, after the completion of said dam in the Columbia River near the head of Grand Coulee, and in such sequence, as the agricultural and economic conditions and the general welfare of the country may justify.

"The works for irrigation purposes described in subsection 2(c) shall be constructed by, and the cost thereof shall be repaid to, the United States in accordance with the reclamation law.

"SEC. 3. (a) There is hereby established a special fund to be known as the Columbia Basin fund (hereinafter referred to as the fund), to be available, as hereafter provided, only for carrying out the provisions of this act. All revenues received in carrying out the provisions of this act shall be paid into and expenditures shall be made out of the fund under the direction of the Secretary of the Interior.

"(b) The Secretary of the Treasury is authorized to advance to the fund, from time to time, and within the appropriations therefor, such amounts as the Secretary of the Interior deems necessary for carrying out the provisions of this act, except that the aggregate amount of such advances shall not exceed the sum of $260,000,000.

"(c) The Secretary of the Interior shall determine the proportion of cost of the works described in section 2(a) and section 2(b) which properly should be charged to flood control and navigation, which amount is not to be reimbursed to the Treasury.

"(d) Moneys in the fund advanced under subdivision (b) of this section shall be available only for expenditures for construction, operation, and maintenance, and the payment of interest, to the extent required, upon the amounts so advanced. No expenditures out of the fund shall be made for operation and maintenance except from appropriations therefor.

"(e) The Secretary of the Treasury shall charge the fund as of June 30 of each year with interest at the rate of 4 per centum per annum on all amounts advanced and remaining unpaid for activities under subsection 2(a) hereof except that portion of such costs allocated to flood control and navigation under subsection 3(c) hereof. No interest shall be charged on advances for activities under sections 2(b) and 2(c).

"(f) The Secretary of the Interior shall certify to the Secretary of the Treasury, at the close of each fiscal year, the amount of money in the fund in excess of the amount necessary for construction, operation and maintenance, and payment of interest. Upon receipt of each such certificate the Secretary of the Treasury is authorized and directed to charge the fund with the amount so certified as repayment of the advances made under subdivision (b), which amount shall be covered into the Treasury to the credit of miscellaneous receipts.

"SEC. 4. There is hereby authorized to be appropriated from time to time, out of any money in the Treasury not otherwise appropriated, such sums of money as may be necessary to carry out the purposes of this act, not exceeding in the aggregate $260,000,000.

"SEC. 5. Before any money is appropriated for the construction of said dam in the Columbia River at Grand Coulee and power plant, and before any construction work thereon is done or contracted for, the Secretary of the Interior shall make provision for revenues by contract, in accordance with the provisions of this act, adequate in his judgment to insure payment of all expenses of operation and maintenance of said works incurred by the United States and for the repayment with interest at 4 per centum per annum, within 50 years, from the date of the completion of said works, of all amounts advanced to the fund for activities under subdivision (a) of section 2 for such works, except for the amount allocated to flood control and navigation.

"SEC. 6. Before any money is appropriated for the construction of works described in section 2 (c) and before any construction work thereon is done or contracted for, the Secretary of the Interior shall make provision for revenues by contract or otherwise adequate in his judgment to insure repayment in the manner provided by the reclamation law, of all expenses of operation and

maintenance and of not less than one-half of the cost of construction of said works, and which revenues together with power revenues not required for other purposes will be adequate in his judgment, to effect repayment of the entire construction cost of said works. Such works may be constructed by divisions or units as specified in section 2 (c) thereof, and contracts for repayments therefor may be made accordingly.

"SEC. 7. Power possibilities upon or in connection with, or resulting from the use of waters conveyed by the works authorized in section 2 (c), are hereby dedicated to, and withdrawn for, development of power for project purposes; provided, however, that any district or association under contract with the United States for payment of construction charges for project irrigation works may upon application to the Secretary of the Interior and upon a finding by him that any such power site is not required for project purposes, utilize such power site, subject to such regulations as the Secretary may prescribe in connection with such use. The Secretary of the Interior may utilize the power possibilities referred to in this section for project purposes primarily but all net revenues from the sale of surplus power resulting from such utilization shall be covered into the fund until all advances to the fund from the general Treasury shall have been liquidated. Net revenues accruing thereafter shall be handled as provided in section 10 hereof. Power plants so constructed, together with transmission lines for the distribution of power therefrom, may be operated and maintained by the Secretary of the Interior until transferred to districts or associations. The cost of power plants so constructed by the said Secretary shall be included with irrigation construction charges, and charges for such power for project purposes shall be limited to operation, maintenance, and replacement expense.

"SEC. 8. There is reserved to the project, subject to the payment of applicable charges, for pumping and incidental necessary purposes all usable power practicably obtainable at power sites described in section 7, together with so much additional power from the Columbia River dam as may be needed. All other power shall be available for disposition in the manner herein provided. Such surplus power when generated at the Columbia River dam shall be sold at the power plant, but power elsewhere generated may be delivered at any point upon transmission lines provided for project purposes.

"SEC. 9. The Secretary of the Interior is hereby authorized, under such general regulations as he may prescribe, to contract for the sale of water and for the delivery therof at such points as may be agreed upon for irrigation and domestic uses, and for the generation of electrical energy and delivery thereof at the power plant to States, municipal corporations, political subdivisions, associations, and private corporations, of electrical energy generated at said dam upon charges that will provide revenue which, in addition to other revenues accruing under the reclamation law and under this act, will in his judgment cover all expenses of operation and maintenance incurred by the United States on account of works constructed under this act, and the payments to the United States as required by sections 5 and 6 hereof, except for the amount allocated to navigation and flood control. No person, organization, or body of whatsoever kind shall have or be entitled to have the use for any purpose of the water stored as aforesaid except by contract made as herein stated.

"SEC. 10. After the repayments to the United States of all money advanced with such interest as is required by this act, charges shall be on such basis as may be fixed by law or regulation and the revenue derived therefrom shall be covered into the reclamation fund.

"SEC. 11. General and uniform regulations shall be prescribed by the said Secretary for the awarding of contracts for the sale and delivery of electrical energy, and for renewals under subdivision (b) of this section, and in making such contracts the following shall govern:

"(a) No contract for electrical energy or for generation of electrical energy shall be of longer duration than fifty years from the date at which such energy is ready for delivery.

"Contracts made pursuant to this section shall be made with a view to obtaining reasonable returns and shall contain provisions whereby at the end of fifteen years from the date of their execution and every ten years thereafter, there shall be readjustment of the contract, upon demand of either party thereto; either upward or downward as to price, as the Secretary of the Interior may find to be justified by competitive conditions at distributing points or competitive centers, and with provisions under which disputes or disagreements

as to interpretations or performance of such contracts shall be determined either by arbitration or court proceedings, the Secretary of the Interior being authorized to act for the United States in such readjustments or proceedings.

"(b) Contracts for the use of water and necessary privileges for the generation and distribution of hydroelectric energy or for the sale and delivery of electrical energy shall be made with responsible applicants therefor who will pay the price fixed by the Secretary of the Interior, with a view to meeting the revenue requirements herein provided for. In case of conflicting applications, if any, such conflicts shall be resolved by the said Secretary, after hearing, with due regard to the public interest, and in conformity with the policy expressed in the Federal water power act as to conflicting applications, for permits and licenses, except that preference to applicants for the use of water and appurtenant works and privileges necessary for the generation and distribution of hydroelectric energy, or for the delivery thereof at the power plant shall be given, first, to States for the generation or purchase of electric energy for use only within their respective borders; second, to municipalities primarily for their own use and purposes incidental thereto; and third, to districts, associations, corporations, and individuals: *Provided, however,* That no application of a municipality or a political subdivision for allocation of electricity shall be denied or another application in conflict therewith be granted on the ground that the bond issue of such municipality or political subdivision necessary to enable the applicant to utilize the electrical energy applied for has not been authorized or marketed, until after a reasonable time, to be determined by the said Secretary of the Interior, has been given to such applicant to have such bond issue authorized and marketed.

"The rights covered by such preference shall be contracted for within six months after notice by the Secretary of the Interior, and the energy or privilege shall be paid for on the same terms and conditions as may be provided for in other similar contracts made by said Secretary. Except as herein otherwise expressly provided, power lessees shall be subject to all provisions of the Federal water power act.

"SEC. 12. The title to the dam and power plant and incidental works described in section 2 (a) shall be and forever remain in the United States, and the United States shall, until otherwise provided by Congress, control, manage, and operate the same.

"SEC. 13. This act shall be deemed a supplement to the reclamation law, which said reclamation law shall govern the construction, operation, and management of the irrigation works herein authorized, except as otherwise herein specifically provided, and subsections I and J of section 4 of the act of December 5, 1924 (43 Stat. 703) shall at no time be held to apply to the operations of the Columbia River dam and power plant or to the net power revenues derived from the operation by the United States of the power plants provided for in section 7 hereof.

"SEC. 14. The construction and operation of works authorized by this act shall in no wise prejudice the rights of the States of Montana and Idaho, or their residents, to store, divert and use any quantity of water required for beneficial use in those States.

"SEC. 15. Collections from licensees under the Federal water power act resulting from assessments made pursuant to section 10 (f) of that act shall be covered into the fund and be available for transfer and expenditure in the same manner as other accruals to the fund.

"SEC. 16. Nothing herein shall be construed as interfering with such rights as the States now have either to the waters within their borders or to adopt such policies and enact such laws as they may deem necessary with respect to the appropriation, control, and use of waters within their borders, so long as such acts do not impair contracts made in pursuance of this act.

"SEC. 17. 'Political subdivision' or 'political subdivisions' as used in this act shall be understood to include any State, irrigation, or other district, municipality, or other governmental organization.

"'Reclamation law' as used in this act shall be understood to mean that certain act of the Congress of the United States approved June 17, 1902, entitled 'An 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,' and the acts amendatory thereof and supplemental thereto.

"'Maintenance' as used herein shall be deemed to include in each instance provision for keeping the works in good operating condition.

"'The Federal water power act' as used in this act shall be understood to mean that certain act of Congress of the United States approved June 10, 1920, entitled 'An act to create a Federal Power Commission; to provide for the improvement of navigation; the development of water power; the use of the public lands in relation thereto; and to repeal section 18 of the river and harbor appropriation act approved August 8, 1917, and for other purposes,' and the acts amendatory thereof and supplemental thereto.

"SEC. 18. The Secretary of the Interior is authorized to promulgate and enforce any rules and regulations necessary to effectuate the purposes of this act.

"SEC. 19. The short title of this act shall be 'Columbia Basin project act.'"

ELWOOD MEAD, *Commissioner.*

The CHAIRMAN. You may now proceed in your own way.

Mr. HILL. I shall speak but briefly of the history of the Columbia Basin project and what we propose to establish. At the outset permit me to call attention to the proposed redraft of H. R. 7446 in the memorandum of the Commissioner of Reclamation accompanying the letter of the Secretary of the Interior to the chairman of your committee in reference to this bill. I respectfully ask the committee to consider this proposed legislation on the basis of such redraft and that you adopt such redraft as a committee amendment, substituting it for all of the original bill after the enacting clause.

The proposal that we present to you in H. R. 7446 is widely different from that considered by the Committee on Irrigation and Reclamation in connection with H. R. 7029, Seventieth Congress, which was also a bill for the adoption of the Columbia Basin project. At that time the project apparently favored was essentially one to rehabilitate by reclamation about 1,800,000 acres of rich but drought-stricken farm land located principally in Grant, Adams, and Franklin Counties in the State of Washington. The project as then considered was a gravity system that involved bringing water some 130 miles from the Pend Oreille River in Idaho and that, through lack of power resources, required early reclamation and settlement of the land in order to finance the work. This system also required storage in Idaho and Montana and therefore the consent of those States before it could be undertaken. The project was lacking in great power resources that could be utilized in building up a large industrial population in the Northwest and therefore creating a market for the agricultural products of the lands reclaimed.

To-day, as a result of exhaustive investigations made by the Corps of Engineers, United States Army, under the direction of Maj. John S. Butler, District Engineer, and the studies based largely thereon by the engineers of the United States Reclamation Service, under the direction of R. F. Walter, Chief Engineer, we are able to present to your committee what Dr. Elwood Mead styles the best combined power and reclamation project left in the arid region of the United States. It is now proposed to construct a large dam and power plant on the mighty Columbia River at the head of the Grand Coulee in the State of Washington as the first and, for many years, the only stage in the development. This dam and power plant will be capable of developing 2,100,000 installed horsepower of cheap electric energy, which can be sold to the utilities, public and private, in the State of Washington, western Montana, northern Idaho, and the northern half of Oregon. The Army report shows that if this power is sold at 2 mills per kilowatt-hour

at the switchboard, it will pay for the dam and power plant in 30 years after the first expenditure thereon and at the end of 40 years leave a surplus of $168,070,000.

The construction of this dam, which will raise the water level of the Columbia about 355 feet and form a lake 151 miles long, will create better than 5,000,000 acre-feet of storage, which can be released in winter when the river is running low, and thus greatly increase the prime power at nine dams on the river, one of which is already built at Rock Island Rapids. This dam, therefore, not only will produce a great amount of power in itself but it will serve as the commanding storage reservoir for the entire Columbia River.

This dam possesses a third remarkable asset. By using only the secondary or flood water power, the water can be economically pumped from the lake formed by the dam into the Grand Coulee, a height varying between 266 and 366 feet, for the gradual reclamation, as needed, of 1,200,000 acres. It is about 38 miles from the river to the project lands. To save canals and to utilize storage for reclamation it is proposed to form a lake in the upper Grand Coulee some 23 miles long and one mile wide by the construction of two inexpensive storage dams. From this lake, the water will be conducted by canal and tunnels about 12 miles to the nearest point of the project lands and the point of division of the canal into the main west and main east canals that lead to the large areas of the project.

At this time, I desire to remove a common misconception about this project. If this project were authorized to-day, it would be impossible to construct it fast enough to interfere with present agricultural surpluses or those likely to occur for many years to come. Under the bill that you are considering with the suggested substitute amendment, the power must be sold before there can be any appropriation for construction. It will then take probably 10 years to complete plans and to construct the dam and power plant. After this, when conditions warrant, it is proposed to construct the first unit of reclamation consisting of some 20 or 25 thousand acres. Since power revenues must be applied to pay not only for the dam and power plant but for half the cost of reclamation, it will be necessary to reclaim the land slowly in order not to throw too much of a burden on the power plant. Accordingly, it is proposed that reclamation shall proceed at the rate of not more than 20 or 25 thousand acres annually. If we were fortunate enough to be able to reclaim the first unit in 1945, it would be about the year 2000 before all of the land could be reclaimed.

However, under the terms of the proposed substitute bill the reclamation of the land can not proceed faster than the surplus revenues from power, over and above requirements for repayment of dam and power-plant construction, will warrant. In fact, the first unit of the land can not be developed until such surplus power revenues have reached the magnitude of being able to repay one-half of the annual installments on the construction costs of such first reclamation unit.

It is estimated that 15 years will be required, after the completion of the dam, for the market to absorb the power and before the maximum of the revenues returnable therefrom will be reached. It is probable, therefore that the first unit of reclamation development

can not be had within less time than 25 years after beginning construction of the dam. The provisions and restrictions of this proposed legislation prevent every possibility of bringing these lands into production earlier than needed.

We will show that the population of the 11 Western States is growing more than twice as fast as that of the United States as a whole and that the increased population of Idaho, Oregon, and Washington will require all of the agricultural products of the project before it can be completed.

We will show that the net cost of reclamation to the settler will be much less than that on existing successful Federal reclamation projects in the State of Washington.

We will also show that the construction of this project will be necessary to provide a home market for our large surpluses in industrial products, now that our foreign trade is dwindling.

It is essential that the project be authorized in order to permit negotiations for the sale of the power. We are not asking a dollar for construction purposes until sufficient contracts have been entered into to pay for the cost of the dam and power plant plus interest on the dam and power plant in 50 years. Authorization now can not possibly place any burden upon the Federal Treasury, and can not for some years. At the same time authorization would be a tremendous factor in restoring confidence and prosperity in the Northwest, the effects of which would react to the benefit of the entire Nation.

The people of the State of Washington have for many years worked and sacrificed to bring about this great development. To-day their hearts are set on its consummation. For years they have witnessed long-continued drought devastate the heart of their State, undermining the stability of large investments made therein. For several decades the population of eastern Washington has been declining and the settled area contracting. Soil erosion has commenced, threatening the destruction of this extremely rich soil. The long-continued interest of the people of the State in the project can be shown by the numerous surveys, a recital of which, together with their costs, will be submitted to you during the hearings.

The people of the State of Washington, through the Columbia Basin Irrigation League, have spent several hundred thousand dollars in efforts to further the project, and the Columbia River Development League has devoted a great deal of effort and some money for the same purpose. Many leading citizens have devoted much time and effort, without any compensation, for the same purpose. The people of the State are united behind the project, and feel that it is absolutely necessary for the future growth and prosperity of the Northwest.

I would further like to refer the committee to the voluminous and most comprehensive report on the Columbia River made by the district engineers, Seattle and Portland, and the division engineer, Portland, to the Chief Engineer, Corps of Engineers, United States Army, and submitted about July 1, 1931. This great report, representing the work of many experts, has not yet been printed, and probably will not be available in printed form until next December. Maj. John S. Butler, who was district engineer at Seattle when this

report was made, is here and will summarize the report as far as it pertains to the Columbia Basin project.

I would like to read into the record an excerpt from the President's message to Congress on February 17, 1932, as follows:

> The conservation of water by storage is required, not alone in the West, but in all parts of the country. The effective development of water conservation through storage is largely an interstate question in the aid of domestic and industrial water supply, transportation, irrigation, and flood control. Where construction work for storage relates to these larger issues, it is properly the work of the Federal Government. Where water power is developed as a by-product, it should be disposed of in advance by contracts which will fairly reimburse the Government for its outlay. The Reclamation Service should be extended to cover these broad purposes of storage and conservation of water rather than the narrow purpose of irrigation. Such important projects as the dam at Boulder Canyon, the dam at Cove Creek, and the development of the Columbia, should ultimately be undertaken where there is need for such service and when contracts can be made for the sale of power to amortize the cost of construction to the Government. The actual construction work under this plan should be carried out by the Public Works Administrator and the completed projects administered by the Reclamation Service.

I would like to present for the record a copy of the report of the Chief Engineer of the United States Reclamation Service on the Columbia Basin project, dated January 7, 1932, with the request that it be printed as an appendix to the record.

The report of the Army engineers on the Columbia River, together with that of the United States Reclamation Service, are a mine of dependable information on the Columbia Basin project and therefore contain almost everything, if not everything, that your committee may desire to know about the project.

Mr. Chairman, the chief engineer of the Reclamation Service has prepared a report on this Columbia Basin project; it is a very informative document and very complete in its details in the description of this project, touching every phase of it. There are some illustrations, tables, and so forth in it that could not be very readily printed in the hearing, but I would like to ask that this report, with such deletions as may be necessary in order to facilitate the printing, be printed as an appendix to the hearings on this bill.

The CHAIRMAN. Very well, gentlemen of the committee, is there any objection?

General MARTIN. Is that a part of House Document No. 308, Sixty-ninth Congress, first session, on the Columbia River up to the boundary?

Mr. HILL. No, it has reference to the Columbia Basin project alone.

Mr. BUTLER. That is the report of the reclamation engineer?

Mr. HILL. Yes.

General MARTIN. That is not House Document No. 308?

Mr. HILL. No, there was a report upon House Document No. 308 made by the War Department engineers, but this report is made by the engineer of the Reclamation Service.

General MARTIN. When was that report made, Judge?

Mr. HILL. Januray 7, 1932.

General MARTIN. I am not familiar with that report.

Mr. HILL. That is the reason I wanted to get it printed, to make it available to us. It looks more voluminous than it will be when it

is printed, because it is just a typewritten document, and typewritten on only one side of the sheet.

Mr. BUTLER. You were suggesting deletions from that document, but would not it be well for you to go over it and make suggestions to the reporter, so that the heart and vitals of the report might not be taken out?

Mr. HILL. Yes, we intend to do that. Mr. Gill, have you gone over this with Commisisoner Mead?

Mr. GILL. Yes, sir; we will take care of that, before it gets into the record.

Mr. HILL. We will indicate definitely just what deletions shall be made.

Mr. SMITH. Why are you in such a hurry about this? Would not the Printing Office take the time to put in the maps?

Mr. HILL. We would be very glad to have those in there, Mr. Smith; we would be delighted to have them in there.

Mr. SMITH. It would take a little more time, but it seems to me, in order to make the report complete, it would be better to take the time and have it printed just as it is.

The CHAIRMAN. It seems to me, gentlemen, that is the wisest course.

Mr. HILL. Then I withdraw any suggestion as to the deletions, and ask to have the report printed as it stands.

The CHAIRMAN. I think that is the better method. If there is no objection on the part of any member of the committee, the chairman will advise——

Mr. SMITH. The only question involved is the expense, and whether it would exceed the allowance for printing of this committee. It will depend on what the printing committee will determine, as to whether we will be exceeding our authority, if we put it in, without some advance information as to the cost. The Public Printer would give you an estimate on the cost, and then you would probably have to take it up with the Committee on Printing, to see if it would exceed our limit.

General MARTIN. I have been very anxious to get that printed, as it is based on House Document No. 308. It is an economic survey.

Mr. SMITH. The War Department is printing it, is it not?

General MARTIN. They would like to print it, but they have got no money. They have got no more money, and it is pretty hard to get it printed.

The CHAIRMAN. Well, gentlemen, if there is no objection to this course, the chairman will inquire and ascertain what credit this committee has for printing, and then the chairman will take it up with the committee again. If we have not sufficient funds, the chairman will take it up with the Committee on Printing and make an effort to have the entire report printed; if not, I will report it back to this committee, and we will take such action as may seem wise.

Mr. HILL. I thank you, Mr. Chairman.

(The report made by the chief engineer of the Reclamation Service to the Commissioner of Reclamation dated January 7, 1932, is printed in full on p. 69 of this record.)

Major BUTLER. For the purpose of trying to clear up the status of this report, I will state that this is a report submitted by the

Chief Engineer of the Bureau of Reclamation, and it is a review of the report made by the Corps of Engineers under authority of House Document No. 308, Sixty-ninth Congress, to which General Martin refers?

Mr. HILL. That is correct, Major Butler.

Major BUTLER. This is a review of the Army report, and it looks as if it should be considered in conjunction with the Army report.

Mr. HILL. I thank you for giving us that additional explanation.

General MARTIN. That puts a new light on it, now. We must have that report (No. 308), because we ought to have it all; it is all the more important now, and we must have the whole report.

Mr. SMITH. Are there very many maps in that report?

General MARTIN. It is very voluminous.

Major BUTLER. I have a part of it here. This is a part of my district report, the Seattle district report.

Mr. HILL. As I read here, the report of the Army Engineers on the Columbia River, together with that of the United States Reclamation Service, are a mine of dependable information on the Columbia River project, and therefore contain almost everything, if not everything, that your committee may desire to know about the project.

The CHAIRMAN. Judge Hill, just one minute. The committee is delighted to have with us Congressman Hadley to participate with us in the hearing.

Mr. HILL. We have here this morning Maj. John S. Butler, who was in actual charge of this survey, not only of the Columbia Basin feature of the river development, but of the entire Columbia River development survey above the Snake River.

We also have Mr. L. N. McClellan, the Chief Electrical Engineer of the United States Reclamation Service; and we shall depend upon them to give us information which will be valuable to the committee in forming its conclusions upon the proposals in this bill.

We have Senator Jones, Congressman Summers, Congressman Horr, and Mr. Bell, representing Senator Dill for the present, anyway, and Mr. Gill, and Mr. O'Sullivan.

The other members of our State delegation are just as deeply interested as those of us who are present, but are unavoidably detained at this time; but their interest is with us in the matter, and the entire delegation is strongly supporting this legislation.

We expect rather extended statements from Senator Jones and Senator Dill and the Members of the House, and while they are here this morning to manifest their interest, we would like to have them, if it is convenient, to appear at a later date and make extended statements on this project; so we might proceed with the engineers who are here from a distance, to take their testimony first. Is that satisfactory?

Senator JONES. Yes, Mr. Hill. I just came over to let you know of my interest in the matter; and I want to say a word in behalf of Senator Dill, that he would be here but he has a committee and other official work that prevents his coming here. We will be very glad to come before the committee at any time that you might arrange.

Mr. HILL. I thank you, Senator Jones. I know you are deeply interested and we appreciate your presence now and at any other time when it is convenient for you to be here.

The CHAIRMAN. Senator Jones, I will say to you that I will arrange a convenient time for you to appear before the committee.

Senator JONES. That is satisfactory.

Mr. HILL. Now, Mr. Chairman, may I present Maj. John S. Butler, the district engineer of the War Department, who made this survey, who was at that time stationed at Seattle, but who is now stationed at Omaha.

STATEMENT OF MAJ. JOHN S. BUTLER, CORPS OF ENGINEERS, UNITED STATES ARMY, WAR DEPARTMENT

Major BUTLER. Mr. Chairman and gentlemen.

The CHAIRMAN. Just one minute, please. Congressman Johnson of Washington has just appeared before the committee, and I desire to state to the Congressman that we just agreed on this program. We will first hear from the engineers, and after that we will hear from the Congressmen at their convenience, you understand. We are glad to have you with us.

Mr. JOHNSON. Thank you very much.

Major BUTLER. With your permission I will first give a synopsis of my report as district engineer, Corps of Engineers, War Department, on the Columbia River above the Snake River, which also covers the proposed Columbia Basin project.

The report on the Columbia River above the mouth of Snake River by the Corps of Engineers, War Department, sets up a comprehensive plan for the full development of that section of the river in the interest of navigation, power, flood control and irrigation.

It is shown that navigation and flood control are not important on this section of the river; that because of the steep slope in the river and the opportunity for creating a well regulated low water flow, there are possibilities for developing large blocks of hydroelectric power at a very low cost, and that there is a very large acreage of best quality land which can be irrigated from the Columbia at a reasonable cost.

It is pointed out that the construction of the so-called gravity plan for placing water on the Columbia Basin project can not be justified as being economically feasible because of the excessive costs.

The pumping plan of placing water on the project is shown as being altogether feasible both from an economic and an engineering viewpoint. This plan provides for the construction of a high dam at the Grand Coulee site on Columbia River of such height as to back the water to the Canadian border and thus utilize all the available head; the construction of a power plant of 1,575,000-kilowatt capacity and of a pumping plant of 16,000 second-feet capacity, the latter to pump water to the Grand Coulee storage reservoir, where the water is then led by gravity to the project for irrigating 1,200,000 acres of land. A main canal 9 miles in length is required for the pumping plan as compared to a main canal 130 miles long, which would be required for the gravity plan.

The high dam at the Grand Coulee site is recommended in the report as a part of the comprehensive plan for the development of this section of the river. It is a part of the comprehensive plan for development of the whole river within the United States recommended to Congress by the War Department. It will provide

5,028,000 acre-feet of useful storage for river regulation, thereby doubling the prime power at every dam site downstream as far as the Snake and materially increasing the prime power on the Columbia below the Snake.

It is estimated that it would take 10 years to construct the dam and power plant at a cost of $171,187,000, of which amount $22,329,000 would be for interest during construction. Studies show that the sale of the power at 2 mills per kilowatt-hour net, or about 2.1 mills gross, would repay all construction costs of the dam and power plant, plus interest, in 30 years, and that at the end of 40 years the accumulated net annual revenue, after full repayment of costs, including interest, would amount to $140,000,000. This would total $168,070,000 with interest at 4 per cent compounded annually. This power could be absorbed into the normal power market tributary to said dam within 15 years after its completion.

The surplus revenue from the sale of the power together with the revenue from the water users on the irrigation project will be sufficient to return to the Government all construction costs of the irrigation project. The pumping necessary for placing water on the project would be accomplished with surplus or secondary power.

The total construction cost of the irrigation project is $221,722,180, or $185 per acre. Of this amount, $40,896,850 represents the interest charges during construction. The construction cost of the irrigation project, without interest, is $151 per acre. The total annual cost of operation, maintenance, and depreciation was estimated to be $4 per acre.

It is pointed out in the report that the combined power and irrigation project, known as the pumping plan is the best and the most economical plan of placing water on the project; and that before any construction work is started by the Federal Government, it should be definitely determined by proper authority that there is or will be at the proper time a market for the sale of the power since otherwise the carrying charges would be so great as to prohibit cheap rates for power.

The report says that the irrigation project itself should not be constructed and settled at too rapid a rate; and that it should not be started until the power development is well underway and until the production from the new area can be absorbed into the markets of the country without causing damage to existing interests through overproduction. It is estimated, however, that the increased population of Washington, Idaho, and Oregon will be sufficient by 1960 to absorb the agricultural products of the project, especially if the project should in the meantime be undertaken.

It is further pointed out that the question of Federal participation involves a matter of national policy that is not within the province of the report to decide.

The following comments relative to the comprehensive plan and the Columbia River irrigation project, as stated, are based upon the report on the Columbia River as prepared by the Corps of Engineers at the request of and for the information of Congress. The report on the upper Columbia River, which covers the Columbia Basin irrigation project, was made under the personal supervision of the speaker when he was district engineer, Seattle, Wash. Congress made provision for a comprehensive survey of the Columbia

in the interests of navigation, power, flood control, and irrigation. This statement applies with equal force to practically all of the navigable streams of the United States and their tributaries whereon power development appears feasible and practicable. The purpose of the survey is clearly expressed in the river and harbor act itself as approved March 3, 1925, section 3.

House Document 308, Sixty-ninth Congress, first session, listed the streams to be considered, contained the estimates asked for and outlined the method to be followed in this investigation. The surveys were finally authorized under section 1 of the river and harbor act of January 21, 1927.

The Columbia is one of the largest rivers in the United States. It is second in size only to the Mississippi in this country and its power possibilities are not exceeded by any of our rivers. The complete, or even partial development of this stream, is a stupendous undertaking, involving outstanding engineering and economic problems, although they are by no means infeasible or insurmountable.

It is well to emphasize that the purpose of the survey by the Corps of Engineers was to formulate a comprehensive plan for the fullest possible development and utilization of the water resources of the stream, having in mind its most effective improvement for the purposes of navigation and the prosecution of such improvement in combination with the most efficient development of the potential water power, the control of floods, and the needs of irrigation.

The Columbia Basin irrigation project is beyond question the most important single or combined project having to do with the development of the resources of the Columbia River. My remarks apply particularly to the upper Columbia River. I say this in explanation to General Martin, who is very much interested in the lower river.

General MARTIN. I am interested in the upper river, too.

Major BUTLER. Surely, sir; but I wish to say that my remarks have largely to do with the upper river, above the mouth of the Snake River.

General MARTIN. Major Butler here is an old friend; he was with me down in Panama.

Major BUTLER. It was my great pleasure and honor to have served under General Martin in Panama.

It may be of interest to give a general description of the river as a whole, the upper river, and its relation to the Columbia Basin project. Gentlemen, I shall point out on the map certain points of interest in connection with these studies. It has been a long time since I have seen this map, but it was in front of me for four years when I was district engineer, Seattle.

To start with, I will state that the Columbia River rises in British Columbia in Columbia Lake, at elevation 2,650 feet, and flows northwesterly for 200 miles; it then turns sharply to the south for 265 miles, a total distance of 465 miles in British Columbia. The river then runs south through the State of Washington to a point near the mouth of the Spokane River, a distance of about 112 miles, and then flows west for something over 100 miles, passing the upper end of the Grand Coulee. It then swings around what we call the Big Bend country to the mouth of the Snake River. The Snake River will not be discussed at this time. The Columbia River then flows in a westerly direction for 324 miles to the ocean.

We are concerned to-day largely with the report of the Seattle district engineer relating to the middle section of the river, which is 424 miles long. This section extends from the Canadian boundary to the Snake River.

The Columbia River is outstanding with respect to its possibilities for the development of power. I think it is quite unique in that it is fed largely by glaciers and snows, of the Rocky Mountain ranges.

The CHAIRMAN. Will you suspend a moment, please?

Congressman Hadley of Washington, we are delighted to have you with us; but I desire to say that the committee has agreed on this program, that is, that it will hear the engineers at the beginning of the hearing and the Congressmen later.

Mr. HADLEY. I thank you, and I have a committee meeting at 11 o'clock, anyway.

General MARTIN. You have made a study of power streams; is it a fact that the Columbia River is the greatest power stream in the world?

Major BUTLER. No, sir; I did not say that. I said that it is second to none in the United States.

General MARTIN. Do you go beyond the United States?

Major BUTLER. No, sir; not in this report.

General MARTIN. Your investigations did not go beyond the United States?

Major BUTLER. No, sir.

General MARTIN. The opinion that I have heard expressed is that it is the greatest power stream in the world.

Major BUTLER. I would not like to make that statement without giving it further consideration.

General MARTIN. Your investigation would show, however, that it is the greatest power stream in the United States?

Major BUTLER. That is my understanding. Several elements which make the Columbia so well adapted to the development of power are the facts that it is fed by glaciers and snows in the mountains in the northwest section and that nature has provided, through a number of large lakes, a wonderful reservoir for feeding out the water during the low-water season. For instance, the Arrow Lakes, 87 miles in length, and Flathead, Pend O'Reille, Couer d'Alene and many other lakes form natural reservoirs for regulating the flow of the stream. The annual run-off of this entire drainage basin of 259,000 square miles, which includes the Snake River and the lower Columbia, is equivalent to a rainfall spread 12¾ inches deep over this entire area or an annual run-off of 146,000,000 acre-feet, which is just about ten times the run-off of the Colorado River at Hoover Dam.

General MARTIN. Ten times the run-off at Hoover Dam?

Major BUTLER. Yes; ten times as great. We are not trying to say anything detrimental to Hoover Dam, however. The maximum flood of the Columbia River, of record, in the upper section, is about three-quarters of one million cubic feet per second. The low water flow at Kettle Falls is about 15,800 cubic feet per second. The low water flow at Rock Island, where the new development by the Puget Sound Power & Light Co. is located, is about 21,000 second feet.

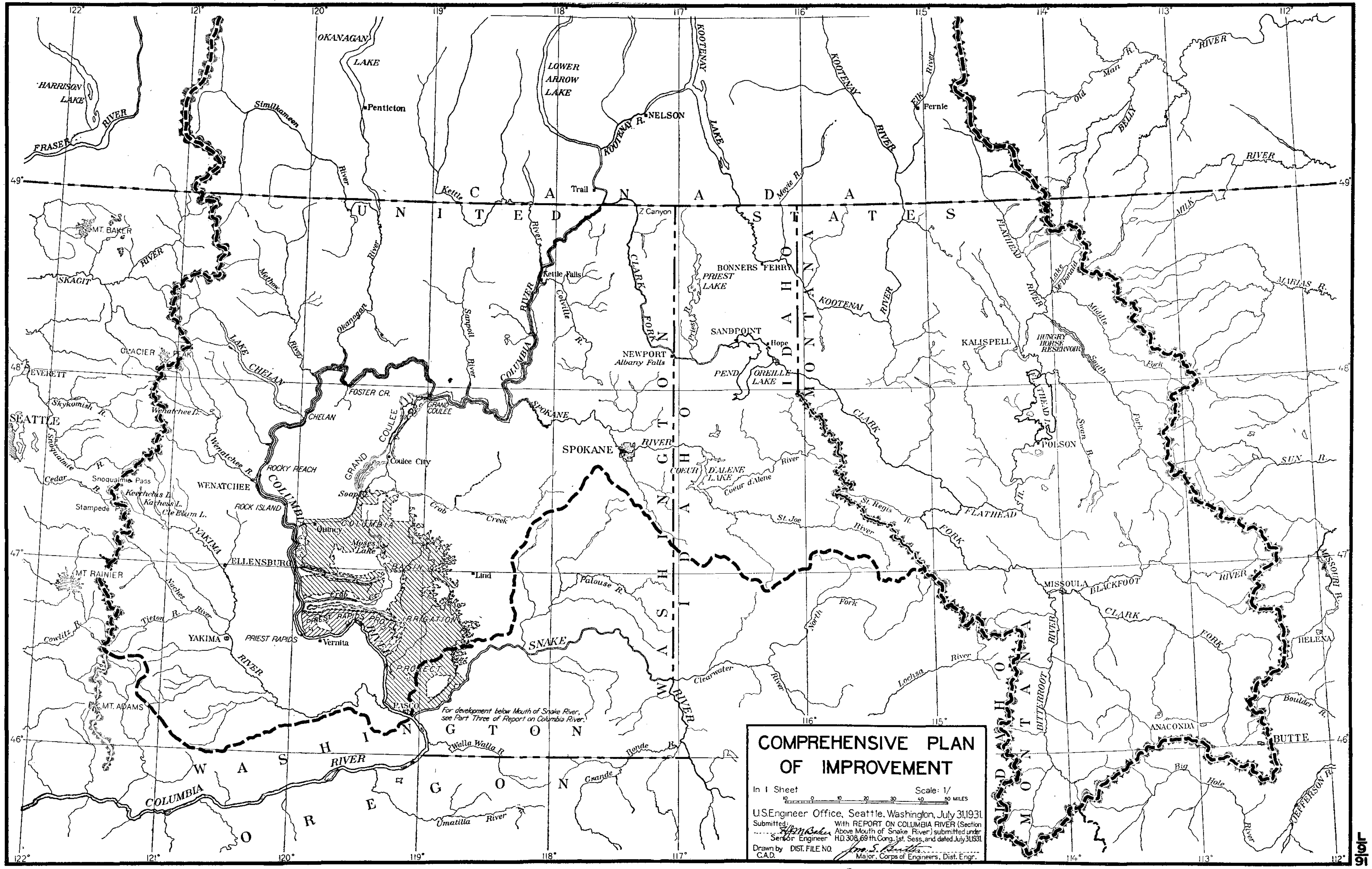

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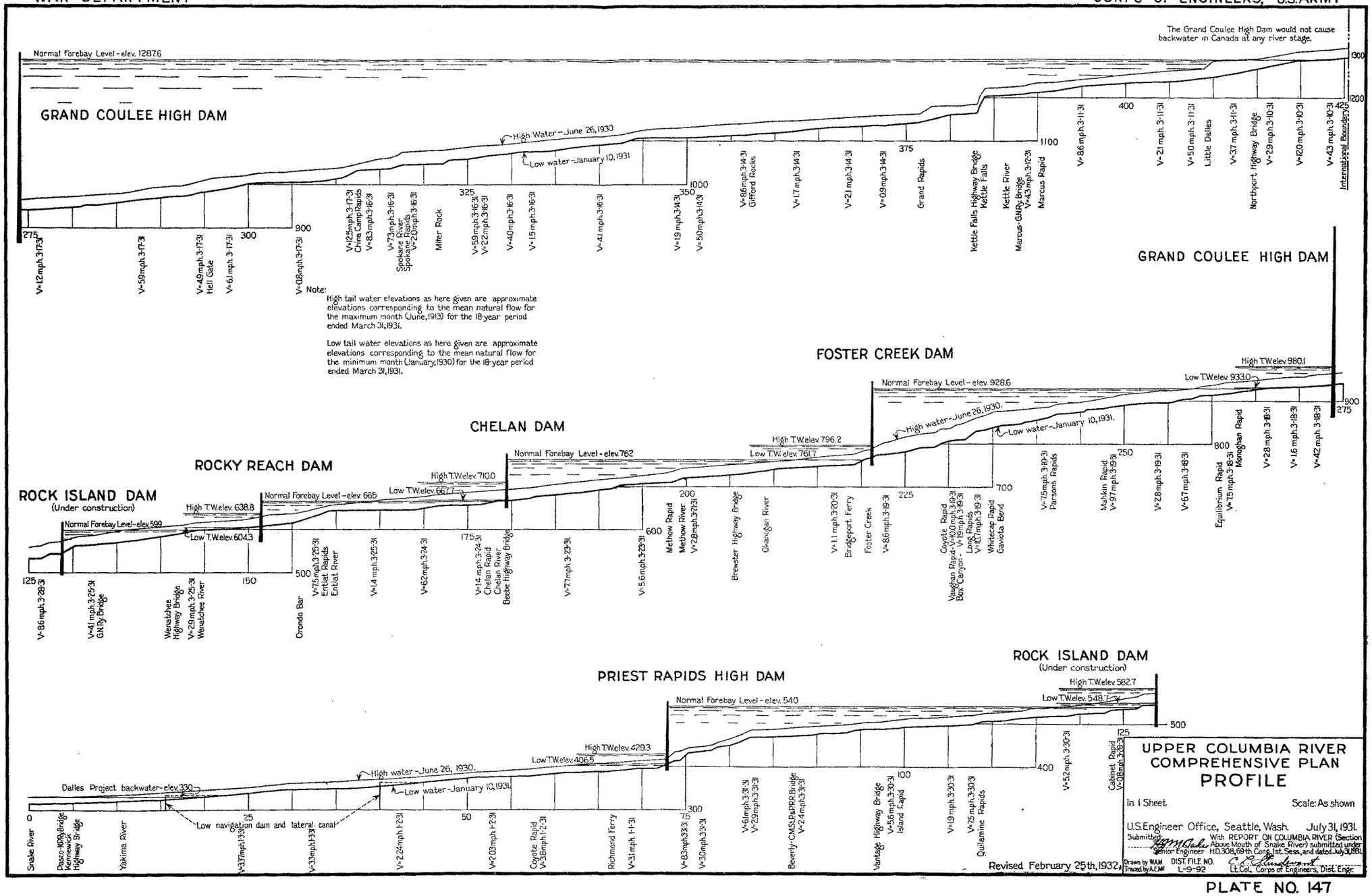
PLATE NO. 146

WAR DEPARTMENT

CORPS OF ENGINEERS, U.S.ARMY



UPPER COLUMBIA RIVER COMPREHENSIVE PLAN

PROFILE

In 1 Sheet

Scale: As shown

U.S. Engineer Office, Seattle, Wash. July 31, 1931.

Submitted with REPORT ON COLUMBIA RIVER (Section Above Mouth of Snake River) submitted under

Senior Engineer H.D. 308, 69th Cong., 1st. Sess., and dated July 31, 1931.

Drawn by WAM
Traced by A.E.M.

DIST. FILE NO. L-9-92

Lt. Col., Corps of Engineers, Dist. Engr.

PLATE NO. 147

125965—32. (Face p. 20.) No. 2

As compared to other streams, this low water flow is a very large percentage of the annual flow, and that is what makes permanent power, valuable power, prime power.

There are many power sites suitable for development along the middle section of the river. This likewise applies to the upper section of the river.

This map I have here is interesting. (See accompanying map, Exhibit 4.) It shows the Canadian border at this point. The elevation of low water at this point is about 1300 feet above sea level; and the elevation of the river at Pasco, at the mouth of the Snake, is about 300 feet. Roughly speaking, the fall in the middle section of the river from the international boundary to the mouth of the Snake is just a little less than 1,000 feet; and our purpose in this comprehensive study has been to get up a plan for the utilization of this head of water. This profile shows, in a rather vivid manner, a series of dams which can be built along the middle section of the Columbia River. (See accompanying profile, Exhibit 5.)

Mr. SMITH. At what places on the river, Major, do you contemplate the dams you refer to?

Major BUTLER. Sites were investigated at the following places which I shall indicate on the map: At Kettle Falls, Grand Coulee, Foster Creek, Chelan, Rocky Reach, Rock Island, and Priest Rapids. (See Plate 146, Exhibit 4.) Plate 146 is a general map of this section showing the comprehensive plan. Plate 147, marked "Exhibit 5," is a profile of the river showing the pools to be formed by the construction of this series of dams.

I will now discuss these sites in more detail. The Kettle Falls site is 40 miles below the Canadian boundary. Application has been made to the Federal Power Commission by the Washington Water Power Co., of Spokane, for the development of this power. License is being withheld pending the outcome of this report. This is an excellent site. A head of about 110 feet can be developed which will carry the pool to the Canadian boundary.

The next site below is what we call the Grand Coulee site in the Columbia River, near the northern end of the Grand Coulee. At this point it is proposed to build a dam about 430 feet high above bedrock, which would give a head of 355 feet at low water. This dam would create a reservoir 151 miles long, which would back the water to the Canadian boundary. We did not do anything that could be objected to by Canada.

The construction of this dam and the creation of this reservoir 151 miles long would be of great value in the development of power, not to speak of reclamation. With a drawdown of 80 feet in the pool created by the dam, we would get a useful storage of 5,028,000 acre-feet of water, which can be used during the low-water season. This storage not only increases the power at this particular site but also at every other downstream site on the river at which dams may in the future be built. This storage and the regulation of the river made possible thereby will more than double the prime power of every dam in the river as far down as the Snake River and will very materially increase the low-water discharge, and hence the prime power, below the Snake. (See table 116, p. 322, Report on Upper Columbia.)

The CHAIRMAN. Major Butler, are we to understand this, that the plan of building a high dam at Grand Coulee will stimulate the power below there, or will be a mechanical arrangement that will give stimulation to the power possibilities at the dams below?

Major BUTLER. Yes, sir. We have throughout this basin a certain amount of annual run-off due to the rains and the melting of the snows and the glacial ice. Now, after the thaws begin in the spring, we have the spring and summer floods that let down more water than is needed. By the construction of this reservoir and by the use of this storage, the flow of the stream can be regulated or equalized so as greatly to increase the prime or commercial power during the low water or winter season and the river can be utilized to better advantage in the dry or summer season when there is greater need for the water for irrigation and for power for irrigation pumping.

The high dam in the Columbia River at the head of the Grand Coulee is included in the comprehensive plan recommended by the Corps of Engineers for the development of the Columbia River. The next dam downstream included in the plan is at Foster Creek. It is really a very good development and has a head of about 164 feet. It is not suitable for the purposes of the Columbia Basin irrigation project but you can develop very cheap power at that place. As we go downstream, the proposed dams included in the comprehensive plan are located at Chelan, Rocky Reach, Rock Island, and Priest Rapids, where very cheap power likewise can be developed. At Rock Island the first installation is complete and in use. That provides for a head of only about 50 feet at low water; it is strictly what you may call a run of the river plant. The dam and power plant there was built by the Stone & Webster Engineering Corporation for the Puget Sound Power & Light Co. There is a maximum head of only 50 feet, and during flood stages the head is practically nothing. So you have practically no power at high water—just a few feet of fall that can not be developed. Normally, such a plant would be of no value.

However, this development was made for the Puget Sound Power & Light Co. and most of their interests are across the Cascade Mountains, on the west side of the Cascades, where they have a number of smaller plants.

General MARTIN. This is a super-power plant, is it?

Major BUTLER. This is the largest plant of the Puget Sound Power & Light Co. When there is a minimum amount of power west of the Cascades, there is a maximum amount of power at Rock Island during the low-water period; and for that reason the Rock Island development works in very satisfactorily with their requirements.

That simply shows that a power plant may be very valuable under some circumstances and it may be practically worthless under other conditions.

General MARTIN. Do you know how much they spent there on that plant?

Major BUTLER. About $15,000,000, sir. I think the full development was estimated to cost about $25,000,000.

At Priest Rapids, 70 miles above the Snake River, there is a good site for a large power development. A dam with a head of 135 feet will back the water to Rock Island and about 648,000 kilowatts (installed capacity) can be generated there at a low cost.

So we have set up here what we consider a comprehensive plan for the development of the middle section of the river, and the Portland district engineer did the same thing for the lower river.

The comprehensive plan recommended by the district engineer, Seattle, for the development of the middle section of the Columbia River, includes, therefore, the following dams and power plants. (See pars. 2000–2007, inclusive, pp. 909–911, inclusive, Report on Upper Columbia.)

Estimated cost, including carrying charges:

Grand Coulee (high dam to back the water to the Canadian boundary)	$171,200,000
Foster Creek	48,300,000
Chelan	39,000,000
Rocky Reach	38,000,000
Rock Island Rapids (built).	
Priest Rapids	60,500,000
Total for power	357,000,000

This plan also includes the regulation of storage in Hungry Horse Reservoir and Flathead Lake for which no estimates have been made. It contemplates that at some future time storage will also be made in Priest, Pend Oreille, and Coeur d'Alene Lakes but this storage for the present is not included in the plan.

This plan includes the irrigation of lands marginal to the river by pumping, and the irrigation of the Columbia Basin irrigation project by pumping from a pool above a high dam at Grand Coulee in the Columbia River.

The district engineer, Portland, recommended for the development of the lower Columbia, below the mouth of the Snake River, two dams and power plants at The Dalles and at Warrendale. These plans have been modified by the Chief of Engineer, Corps of Engineers, War Department, so that four dams and power plants instead of two in the lower river are recommended as a part of the comprehensive plan. These dams are to be at Umatilla Rapids, John Day Rapids, The Dalles, and Warrendale. In his letter to the Secretary of War, dated March 29, 1932, Maj. Gen. Lytle Brown, Chief of Engineers, Corps of Engineers, War Department, says:

The sites determined by the Board of Engineers for Rivers and Harbors as most promising, all things considered, are at 10 localities, namely:

(1) Head of Grand Coulee, Wash.
(2) Foster Creek, Wash.
(3) Chelan, Wash.
(4) Rocky Reach, Wash.
(5) Rock Island Rapids, Wash.
(6) Priest Rapids, Wash.
(7) Umatilla Rapids, Oreg.
(8) John Day Rapids, Oreg.
(9) The Dalles, Oreg.-Wash.
(10) Warrendale, Oreg.-Wash.

He further says:

That no license be issued for the purpose of constructing dams or for power development on the Columbia River which is not in accordance with the general plan for combined development for navigation and power as recommended by the board, subject to such modifications as may be approved by the Chief of Engineers and the Secretary of War in conformity with the purpose [illegible] at plan to secure the most effective improvement best adapted to the pu[illegible] navigation in combination with water power development.

I request that a copy of the report of the Chief of En[illegible] printed as a part of this hearing.

(The report referred to is here printed in full as follows:)

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 29, 1932.

Subject: Report on the Columbia River and minor tributaries.
To: The Secretary of War.

1. I submit, for transmission to Congress, my report with accompanying papers and illustrations on Columbia River and minor tributaries, made under the provisions of House Document No. 308, Sixty-ninth Congress, first session, which was enacted into law with modifications, in section 1 of the river and harbor act approved January 21, 1927. As defined in the document and in the river and harbor act of March 3, 1925, the primary purpose of this report is "the formulation of general plans for the most effective improvement of the river for the purposes of navigation, and the prosecution of such improvement in combination with the most efficient development of the potential water power, the control of floods, and the needs of irrigation." The survey is sufficient for the general purpose indicated.

NAVIGATION

2. Columbia River from a standpoint of navigation may be divided into three sections; namely, the tidal or lower section extending from the mouth to a point about 140 miles from the mouth; the middle section extending from the head of tidewater to the mouth of Snake River, a distance of about 180 miles; and the upper section extending from the mouth of Snake River to the international boundary, about 424 miles.

3. The project now authorized by Congress for the tidal section provides for a channel through the ocean bar at the mouth of the river 40 feet deep and not less than one-half a mile wide; for a channel thence to the mouth of the Willamette River 500 feet wide and 35 feet deep, to be provided in cooperation with the improvement by the port of Portland of the Willamette River to Portland, Oreg.; and for a channel 25 feet deep and 300 feet wide to Vancouver, Wash., 4½ miles above the mouth of the Willamette River, to be provided in cooperation with the port of Vancouver. In a separate report submitted to Congress February 12, 1932, modification of the project to provide a depth of 28 feet to Vancouver, with suitable turning basins, is recommended. If so modified, the present project for navigation on the tidal section will be adequate. The effective improvement of the tidal section for navigation can not be combined with the development of potential water power, the control of floods, or the needs of irrigation. This project for navigation needs no further mention at this time.

4. The middle section is obstructed by rapids. The Cascade Gorge at the head of tidewater completely blocked navigation before improvement. Navigation past the rapids of the gorge is now afforded by a canal with a lock affording a depth of 8 feet, which was completed in 1896. The next major obstacle to navigation is the Celila Falls, 200 miles from the mouth. Navigation past the falls is provided by a lateral canal known as The Dalles—Celilo Canal completed in 1919 with five locks with chambers 45 by 265 feet in dimension and affording a depth of 8 feet. From Celilo Falls to the mouth of Snake River the existing project provides for removing obstructing boulders and ledges to provide safe navigation of such channels as exist. The controlling depth over the shoals is about 4 feet at low water. Channels through all of the rapids are generally 100 feet or more in width. Because of the swift currents in the middle section of the river, including the approaches to the Cascade Locks, it can be navigated only by high-powered boats of relatively small cargo capacity, and is not suitable for modern barge navigation.

5. There is no project for navigation above the mouth of Snake River except in the reach, Wenatchee-Bridgeport-Kettle Falls, about 240 miles in length, where open river work has been prosecuted to obtain a depth of 5 to 7 feet. Rapids and swift water make navigation in this reach a difficult and costly means of commercial transportation. Such traffic as there is on the river is local, and under present conditions there is no prospect of developing a waterborne commerce on the upper Columbia.

6. The tidal lower section of the Columbia has a large and important commerce. The present commerce on the middle section is unimportant, but

there is every reason to anticipate a substantial commerce with large transportation economies if the river is improved for efficient and economical barge navigation. While the amount of this commerce, and the savings in transportation costs can not be certainly estimated, yet the figures presented by the district and division engineers are considered a suitable basis for determining the value of the improvement from a navigation standpoint. These figures show a movement of 600,000 tons of freight, with an estimated savings of somewhat more than $1,000,000 per annum. The effective method for improving the middle section of the river for navigation is in combination with the development of potential water power. The estimated cost of the locks and channel enlargement necessary for navigation in such combined development is $16,100,000. The potential navigation on the middle section is of such value as to warrant the requirement that power developments be designed on the general lines recommended by the Board of Engineers for Rivers and Harbors to provide pools suitable for navigation; and the public benefits from navigation are sufficient to warrant the assumption by the Federal Government of the entire cost of the necessary locks and channel enlargement.

POWER DEVELOPMENT

7. The Columbia River and its tributaries are susceptible of being developed into the greatest system for water power to be found anywhere in the United States. The power can be developed at low cost. The sites determined by the Board of Engineers for Rivers and Harbors as most promising, all things considered, are at 10 localities, namely:

(1) Head of Grand Coulee, Wash.
(2) Foster Creek, Wash.
(3) Chelan, Wash.
(4) Rocky Reach, Wash.
(5) Rock Island Rapids, Wash.
(6) Priest Rapids, Wash.
(7) Umatilla Rapids, Oreg.
(8) John Day Rapids, Oreg.
(9) The Dalles, Oreg.-Wash.
(10) Warrendale, Oreg.-Wash.

8. Of these, the one at Rock Island Rapids is under construction by private enterprise.

9. The structures contemplated in the scheme for power development are all on a large scale, some on a grand scale, and the conditions at some of them as to foundations and flood discharge over the dams are without precedent. There is nothing, however, to cause a belief that the engineering difficulties can not be surmounted.

10. There is a desire, which is natural, to make more extended engineering investigations at this time. I believe that there are enough data on hand on which to base any major decisions that may be required by Federal authority. Detailed investigations will be in order following these decisions or they may be unnecessary.

11. The cost of this development will exceed that of any other single development of any kind for power that has ever been made. Assuming money at 4 per cent, the estimated costs of these power installations including interest during construction are as follows: Grand Coulee, $204,500,000; Foster Creek, $49,000,000; Chelan, $39,000,000; Rocky Reach, $38,000,000; Priest Rapids, $63,000,000; Umatilla Rapids, $60,000,000; John Day Rapids, $110,000,000; The Dalles, $89,000,000; Warrendale, $59,000,000; total of these devolpments about $711,000,000. If money is 6 per cent the total would be about $772,000,000. The Grand Coulee and The Dalles installations are outstanding because of size. The ultimate development to be foreseen would have an installed capacity of about 8,000,000 kilowatts. The Grand Coulee development alone would be able to meet any probable increase in power needs of the accessible area for a period of 30 years in the future.

12. There is evidence in this report to show that the power of the Columbia River may be developed economically, provided it be done in such increments as not to outrun the demands of the market. A combination or close coordination of the entire power industry in the region is necessary to secure economic results by guarding against overproduction.

13. The power interest on the Columbia River above the tidal or lower section is by far the most important feature in the development of the river.

FLOOD CONTROL

14. There is a problem of flood control on the lower Columbia. It is independent of other interests, though it will be ameliorated somewhat by the large power installations if they are made with provisions for storage. It can be solved by local interests whenever the economics of the situation justify the building of better levees.

IRRIGATION

15. From the data at hand, about 2,000,000 acres of land along the Columbia River in the United States are susceptible of irrigation from that river.

16. The irrigation of the bulk of this land in the most economical manner depends on cheap power for pumping. Irrigation therefore depends on power installation to that degree.

17. There is a much more serious question of the economic feasibility of irrigation here than there is of power development. In fact the local reports demonstrate that the irrigation of land as pertains to the Columbia River area under consideration is not an economical proposition at this time and should await the future.

18. The policy of bringing more land under cultivation at present by large expenditures of general funds and in competition with other lands already under cultivation is questioned by agricultural authorities of the General Government.

CONCLUSIONS

(*a*) Navigation interests on the lower Columbia River at present are sufficiently served by the projects heretofore adopted or recommended.

(*b*) Power development on the Columbia River is feasible and the economy of the development appears favorable, provided all power development in the region is coordinated to insure against overproduction.

(*c*) Irrigation as a part of the combined development of the Columbia River is not at the present time economical considered alone. In the power development there should be a reservation placed on power at the cost of production for purposes of irrigation in the future.

(*d*) Flood control is a minor interest and susceptible of easy solution by local interests.

19. I recommend as follows:

(*a*) That the project for the improvement of navigation on the lower Columbia River as heretofore adopted or recommended.

(*b*) That the existing projects for the improvement of the Columbia River between Vancouver and the mouth of Snake River be modified to provide for the construction by the Federal Government of locks having a depth of not less than 9 feet over the sills at low water and of suitable dimensions for modern barge traffic, at any dams built in this section of the river under authority of the Federal water power act, and in accordance with the comprehensive plan of improvement for navigation in combination with the development of water power; together with a channel enlargement for navigation purposes, all at an estimated cost of $16,100,000, with $300,000 annually for maintenance and operation.

(*c*) That the project for navigation on the upper Columbia River, the section between the mouth of the Snake River and the international boundary, remain as adopted at present, except that power installations, which shall be made on this section, shall conform to such requirements as to navigation in the future with a view of slackwater navigation of a depth of not less than 9 feet, as the Secretary of War on the recommendation of the Chief of Engineers may prescribed.

(*d*) That the power devolopments on the Columbia River shall be made on application of local governmental authority or private interests under restriction of the Federal water power act with the prescription of reserved demands of power at cost of production, in such amount as may be made and determined in the interest of irrigation by the Secretary of the Interior.

(*e*) That Federal projects for works for irrigation to be supplied with water from the Columbia River or its tributaries, shall be prepared by the Secretary of the Interior, when their preparation is authorized by direction of law.

(*f*) That no license be issued for the purpose of constructing dams or for power development on the Columbia River which is not in accordance with

the general plan for combined development for navigation and power as recommended by the Board, subject to such modifications as may be approved by the Chief of Engineers and the Secretary of War in conformity with the purpose of that plan to secure the most effective improvement best adapted to the purposes of navigation in combination with water power development.

20. This report has been submitted to the Commissioner of Reclamation of the Department of the Interior who concurs generally with the views expressed therein. The following letter from the Commissioner of Reclamation expresses his views:

"MARCH 19, 1932.

"MY DEAR GENERAL BROWN: The opportunity you have given me to read your report on the development of the Columbia River made by the Corps of Engineers of the Army is highly appreciated and in response to your invitation, I submit the following comments:

"The only portion of the investigations dealt with in this report which concerns the work of the Bureau of Reclamation is that relating to the utilization of the river at Grand Coulee, through the construction and operation of power and irrigation works. With your conclusions regarding this, I am in accord and it is a pleasure to be able to state that there is a complete agreement between the engineers of the War Department and those of this bureau regarding the plans which should be adopted for irrigation and power development, and the estimates of cost.

"To your views of conditions as they exist at this time, I should like to add my belief that no development of the land and water resources of the arid region equals this in importance and in the beneficial results which would come. It will enable the largest single water supply of the arid region to be utilized to give cheap power to industries, and make feasible the irrigation of the largest and finest body of unreclaimed land left in the arid region.

"I am in agreement with your conclusions that this development to be solvent must be based on the revenues from power and that these revenues must contribute to the cost of the irrigation works to avoid injurious burdens on irrigation farmers; also, that there is not at present a demand for these farms or for the crops to be grown on them. Development, if inaugurated immediately, would not, however, be in opposition to this view. It will require at least 10 years after the works are authorized, to build the dam and the power plant and another 10 or 15 years to absorb the power thus made available. These things must precede the large expenditure to build the works required for irrigation. By that time the increase in population of the cities of Spokane, Seattle, Tacoma, and Portland, and all the other cities and towns of the Northwest, will provide a local market for the products of these farms. They will be an essential element in the economic and prosperous development of this region.

"Very truly yours,

"ELWOOD MEAD, *Commissioner.*"

LYTLE BROWN,
Major General,
Chief of Engineers.

(NOTE.—Costs given above includes the capitalization of carrying charges.)

Major BUTLER. In his letter to Hon. John Thomas, chairman of the Senate Committee on Irrigation and Reclamation, dated May 7, 1932, in relation to Senate bill 4408 providing for the construction of four dams in the river below the mouth of the Snake River and for other works, the Secretary of War says:

The consideration of the development of the Columbia River should include the major project set forth in the report of this department, and now before Congress, for the construction of a dam and reservoir at Grand Coulee above the mouth of Snake River, for the development of power mainly, but possibly, in the future, the development of irrigation.

I respectfully request that the copy of this letter be printed as a part of this hearing.

(The letter referred to is here printed in full as follows:)

WAR DEPARTMENT,
Washington, May 7, 1932.

Hon. JOHN THOMAS,
Chairman Committee on Irrigation and Reclamation,
United States Senate, Washington, D. C.

DEAR SENATOR THOMAS: In accordance with the request contained in your letter of April 28, the careful consideration of the department has been given to the bill (S. 4408) to provide for construction of works for the development of the Columbia River. This bill provides for the construction of four dams in the Columbia River between tidewater and the mouth of Snake River, for development of water power and for providing facilities for modern barge navigation through this section of the river, the work to be done by the Federal Government under the direction of the Secretary of War, and financed by substantially the method adopted for the Boulder Canyon project on the Colorado River.

It is noted that the limiting sums which may be advanced for the various undertakings under the proposed authorization as set forth in lines 20 to 22 on page 3 of the bill do not include the estimated amount required for the construction of the locks at the several dams, and the amounts should therefore be increased as follows: Warrendale, $64,000,000; Celilo Falls, $91,000,000; John Day Rapids, $116,000,000; Umatilla Rapids, $64,000,000. Similarly on page 5, line 11, the total authorized appropriation should be $335,000,000 to include the estimated sums necessary for the construction of the navigation locks.

The President in his message of February 17, 1932, expressed his views as follows:

"The effective development of water conservation through storage is largely an interstate question in the aid of domestic and industrial water supply, transportation, irrigation, and flood control. Where construction work for storage relates to these larger issues, it is properly the work of the Federal Government. Where water power is developed as a by-product, it should be disposed of in advance by contracts which will fairly reimburse the Government for its outlay. The Reclamation Service should be extended to cover these broad purposes of storage and conservation of water rather than the narrow purpose of irrigation. Such important projects as the dam at Boulder Canyon, the dam at Cove Creek, and the development of the Columbia, should ultimately be undertaken when there is need for such service and when contracts can be made for the sale of power to amortize the cost of construction to the Government. The actual construction work under this plan should be carried out by the public works administrator and the completed projects administered by the Reclamation Service."

These views relate primarily to the effective improvement of water conservation through storage. The project proposed in the bill is primarily for the purpose of developing the power resources of the river below the mouth of the Snake River in combination with the improvement for modern barge navigation in this region, and does not include nor does it require the comprehensive conservation of water by storage.

The consideration of the development of the Columbia River should include the major propect set forth in the report of this Department, and now before Congress, for the construction of a dam and reservoir at Grand Coulee above the mouth of Snake River, for the development of power mainly, but possibly, in the future, the development of irrigation. The sale of this power is an essential feature in the economic feasibility of such a project. Since the market for power is a determining factor both in the economic development of the power and navigation project below the mouth of Snake River and in the power and irrigation project above the mouth of the Snake River, it appears evident that an authorization for the development of the Columbia should be broad in scope under a single executive head as contemplated by the President, to the end that negotiations for the sale of power and the coordination of power and navigation as well as irrigation requirements may not be divided between different Federal agencies.

The War Department can do this work as the bill contemplates, and on this score there is no occasion for delay. Accommodation to the prospective organization held in view by the President can be made as soon as that organization materializes, therefore there is no delay to be anticipated on this score.

The proper development of the Columbia River would undoubtedly create a great asset for that section of the nation where it is located, and of course in doing so it would be a national as well as a local asset. However, until the nation has passed the present financial crisis, I could not recommend a great expenditure of public funds that can property be postponed.

I regard the creation of further indebtedness by the Federal Government at this time as inadvisable. I therefore recommend that this bill or any modification of it be held in abeyance until the nation is better able to meet the financial outlay involved.

Sincerely yours,

PATRICK J. HURLEY,
Secretary of War.

Major BUTLER. The report of the district engineer, Seattle, shows that it will be possible to develope useful storage in the lakes, etc., feeding the Columbia River that are located in the United States above the Grand Coulee site as follows:

	Acre-feet
Hungry Horse	1,100,000
Flathead Lake	1,540,000
Pend Oreille Lake	1,620,000
Priest Lake	569,000
Kootenay Lake	715,000
Coeur d'Alene Lake	430,000
Total	5,974,000

I would refer you to paragraph 78, page 77, of the original manuscript of the above report.

It is estimated that the use of the 5,028,000 acre-feet of storage created by the high dam at the head of the Grand Coulee will increase the minimum flow (17,000 second-feet) at that dam site to an average flow of 40,400 second-feet during the 182-day low-water period from October 1 to March 31, based upon the record of flow from April, 1913, to March 31, 1931. While the above storage makes extensive river regulation possible without depending upon upstream storage and while, as a result, the success of the Columbia Basin irrigation project is not necessarily dependent upon upstream storage, nevertheless this upstream storage will ultimately add greatly to the development of prime power throughout the river. The use of this storage would increase the minimum low-water flow at Grand Coulee from 17,000 second-feet to 32,900 second-feet.

This upstream storage will probably come as the result of power development and there is a provision in the Federal water power act whereby interests downstream that are benefited may be made to bear their proportionate share of the cost.

In table 15, paragraph 252 of the report of the district engineer, Seattle, we have provided for all the irrigable acreage above the Snake River, including that in British Columbia, Idaho, and Montana and made what we thought was a very liberal estimate. We found that "the abundant water supply of the upper Columbia and tributaries can serve all of the irrigable acreage within practicable economic reach, with only slight detriment to water power resources." See paragraphs 251 to 264, inclusive, of above report.

This [pointing to the map] is Flathead River, and this shows a possible reservoir and power site at Hungry Horse Canyon, near the Glacier National Park. The construction of a dam from 365 to 480 feet high at this site would make it a very valuable power

development and make possible the effective storage of about 1,100,000 acre-feet (gross 1,550,000) of water, which would be helpful in the way of flood control, particularly on Flathead and Pend Oreille Lakes.

The CHAIRMAN. Now, is that included in the Columbia Basin project?

Major BUTLER. Only indirectly, sir. We have included it in our comprehensive plan, and we have pointed out the possibility of development in the future. The Flathead River comes down here [pointing to the map] and runs into the Clark's Fork River or Pend Oreille and then it swings here and goes off to the Northwest, into British Columbia, and then joins the Columbia River a short distance above the international boundary. This lake, the Pend Oreille, provides for a storage of about 1,600,000 acre-feet.

There is one power development here below the outlet to Flathead Lake which has been started by the Rocky Mountain Power Co., which is the same as the Montana Power Co. Work on this project has been suspended on account of the depression and resulting change in demand for power. There is a series of dams which can be built below the Rocky Mountain development. That power can be augmented by the construction of this reservoir in Flathead Lake.

Now, one of the first things we did in taking up this investigation was to make a study of the so-called gravity plan for putting water on the Columbia Basin irrigation project. All of the area shown here [pointing to the map] represents lands lying within the boundaries of the Columbia Basin project.

The CHAIRMAN. Could you give us the approximate acreage in there?

Major BUTLER. In that portion shown in red there are about 2,000,000 acres. That simply is a general picture of the whole area. There are many sections of that area, such as Saddle Mountains and other sections, where the land is not altogether suitable for irrigation, and for this reason we have thrown them out and have given them no consideration. An old report by the State of Washington estimated that there was 1,883,000 acres in that area available for irrigation. There is that much land within the area but there is a question whether or not it will be economic to put water on all of it. For the purposes of our studies, we have considered but 1,200,000 in the area that can be economically reclaimed from the Columbia River.

As stated, we first considered the so-called gravity plan of placing water on the project, a plan that had been considered in previous reports.

The CHAIRMAN. What was the objection to the gravity plan?

Major BUTLER. Well, it was the excessive cost of the plan. I will outline, briefly, just what the gravity plan consists of. In the first place, it was necessary to make a careful study of the water supply; we had to get enough water to put on the project, and we found that we did not have enough water from Lake Pend Oreille, that is, during the low water season. For that reason, it would be necessary to build a dam near Newport, at Albany Falls, within the State of Idaho. This dam, about 40 feet high, would back the water into Lake Pend Oreille and thus creates a storage of about 1,600,000

acre feet in that lake, which could be used during the dry season for irrigating this block of land in the Columbia Basin project.

In order to do that, it would be necessary to build this low dam and then a series of tunnels and canals, aggregating a length of about 130 miles, from Albany Falls to the point here (pointing to the map), where the water would be distributed over the project. This, for instance, involved an item of $105,000,000 to cover the cost of tunnels alone. There is one place, shown by the dotted line there [indicating], where the plan would require two parallel tunnels 16 miles long and about 32 feet in diameter. These tunnels would have to be driven through solid basalt rock, which is harder than granite, and they would have to be lined with concrete. The length of tunnels required would be about 33 miles.

General MARTIN. The gravity system depended on Pend Oreille?

Major BUTLER. Yes, sir.

General MARTIN. And not the Columbia?

Major BUTLER. It would depend on the storage of water in Lake Pend Oreille. We went further and made a study of the possibilities of using a certain amount of water from Lake Coeur D'Alene by increasing the storage in that lake somewhat. As a result, we found that we could reduce the costs by cutting down the capacity of the tunnels and the canal north of the Spokane River. However, our studies show that the "gravity plan" is not economically feasible.

Then other plans for putting water on the project were considered. One plan would bring the water from Lake Wenatchee to about 360,000 acres of fine land in the Quincy area, which is within the Columbia Basin project. This plan would involve the construction of a canal about 80 or 90 miles long and the crossing of the Columbia River. We also considered the possibility of pumping from the Columbia at different places. But our final studies have shown that the best plan that we could devise consists of the construction of a high dam and a power plant in the Columbia River at the upper end of the Grand Coulee, a pumping plant for raising the water to the Grand Coulee storage reservoir, and the distribution of the water by gravity to the land.

Our studies also showed that it would be necessary to build the high dam in the Columbia at the upper end of the Grand Coulee in order to have enough power to make the Columbia Basin irrigation project economically feasible.

If there are any questions that anyone would like to ask while I am here at the map, I will be glad to answer them.

It may be interesting, gentlemen, to state that there is an area here of about 9,000 square miles in this Big Bend section where the annual run-off from the rainfall is zero; in other words, practically none of the water that falls in that section gets into the Columbia River except possibly a little seepage.

The CHAIRMAN. Major, can you give us an approximate idea of what the power might be worth, that is, how much of the power might be utilized from Grand Coulee?

Major BUTLER. Yes, sir; I will get to that point later. May I continue with my comments now?

The CHAIRMAN. Yes. Take you time, Major. It will be the policy of the committee to have a thorough hearing.

Mr. HILL. Mr. Chairman, may I ask a question at this point?

The CHAIRMAN. Yes.

Mr. HILL. You mentioned the fact that under the original plan of the gravity system there was contemplated the reclamation of about 1,800,000 acres. What number of acres does the present plan contemplate?

Major BUTLER. I intended to make that statement. About 1,200,000 acres.

The CHAIRMAN. I think you said that.

Mr. HORR. May I ask the major a question?

The CHAIRMAN. Yes.

Mr. HORR. Are you in a position, at this time, to tell us what the entire power developed on this project would be, less the amount that has already been taken up by private interests?

Major BUTLER. I do not quite understand, sir.

Mr. HORR. I mean the entire development of power, how much would be produced, less the amount that has already been taken over by other interests?

Major BUTLER. Yes; we have complete information in the report.

Mr. HORR. Is it in there now?

Major BUTLER. Yes; as to the power possibility within that area and furthermore the developed power by private interests. We made a very careful study of the market for the power.

Mr. HORR. You have not those figures in mind, have you, as to the amount of kilowatt-hours developed?

Major BUTLER. No; not exactly. There is roughly about 1,200,000 installed kilowatts generated or under construction in that area. See pages 263, 264, 487, and 550 and plate 125 of district engineer's report on Upper Columbia River.

The gravity plan of placing water on the project was the first one to be given consideration and this required a careful study of the water supply. The Clark's Ford or Pend Oreille River was found to be the best source of supply for the gravity system but as stated this supply would have to be augmented by storage in Pend Oreille Lake. This problem was made somewhat difficult because there was another State, namely Idaho, involved. It then became an interstate question.

The report of the Corps of Engineers has demonstrated beyond a reasonable doubt that the gravity plan of placing water on the project can not be justified under any circumstances because of the excessive construction costs, even with interest free money. This plan will therefore be given no further consideration at this time.

The pumping plan of placing water in the Columbia Basin irrigation project was then given careful consideration and investigation. This project avoided any interstate complications since it was entirely within the State of Washington and it had many economic advantages.

The pumping plan can be more than justified on an economic basis when the indirect benefits are considered.

It can likewise be justified by the direct benefits, or actual return on the investment or improvement. The returns from the water users alone on the irrigation project will not justify construction. However, when considered as a combined power and irrigation plan,

where income derived from the sale of power will be an aid, the construction cost can be returned to the Government with interest at 4 per cent, and within a reasonable time, as far as the cost of the dam and power plant are concerned, and the construction costs of the irrigation project can be returned, without interest. I do not know whether I made that clear or not, but if it is not clear, I will be glad to try to clear it up. The point is that if you consider the irrigation project alone, without relation to the power development, the returns from the water users can not be made to carry the entire construction costs of irrigation. For that reason, then, it becomes necessary to combine the irrigation project with the power development and to obtain revenue by the sale of the power for commercial purposes. In this manner, the revenue derivable from power will not only repay the Government for the cost of the power development, that is, the cost of the dam and power plant, but it will also take care of the balance of the costs of the irrigation project which the water users will not be able to pay.

Mr. SMITH. Have you reduced your investigation and calculation to an acre cost?

Major BUTLER. Yes.

Mr. SMITH. So you are prepared to give that?

Major BUTLER. Yes; we can give you the per acre cost.

Mr. SMITH. To the owner of the land?

Major BUTLER. Yes. We made different set-ups of the acre costs depending upon the rate of settlement, whether interest on reclamation was charged or not and the rate at which the power was sold etc. For the purposes of the calculations we assumed that work on the reclamation project would begin in the third year from the beginning of work on the dam. There is not time to give all of these set-ups. The construction cost, per acre, with interest during construction, is $185; without interest it is $151 an acre under plan 4 which contemplates the irrigation of all the 1,200,000 acres from the Columbia at the Grand Coulee. Our calculations show that if no interest is charged against the reclamation part of the project, the power revenues will be sufficient to pay about one-half the cost of reclamation. It is also possible, if reclamation is deferred until the power is well absorbed that the power revenues will be sufficient to pay about half the reclamation costs, even if interest is charged.

The development of the pumping plan of the Columbia Basin irrigation project involves among other items, the construction of the following features, some of which I think I have already outlined:

The first is a high dam in the Columbia River near the north end of the Grande Coulee. This dam will be about 430 feet in overall height above bedrock, with a maximum power head of 355 feet at low water. It will be about three-quarters of a mile long on the crest and will contain about 11,000,000 cubic yards of concrete. The reservoir in the Columbia formed by the dam will be 151 miles long, reaching to the Canadian border, and it will impound 5,028,000 acre-feet of useful storage water. This storage has an untold value since it will increase the firm power for all future plants down the stream, below that point.

Second, the installed capacity of the power plant will be 15 units of 105,000 kilowatts capacity each, or a total plant capacity of

1,575,000 kilowatts, which is the same as 2,100,000 horsepower. We do not like to make any comparison with the valuable development at Hoover Dam, but this plant will yield better than 65 per cent more power.

Third, the pumping unit to lift 16,000 second-feet of water from the pool formed by the dam in the Columbia to the reservoir in the bed of Grand Coulee, a vertical distance varying from about 267 to 365 feet, depending upon the stage of the river and the amount of water in the reservoir.

Fourth, a low earth dam at each end of the Grand Coulee, to form a secondary storage reservoir, from which water is to be led by gravity, through a 9-mile main irrigation canal, to be distributed over 1,200,000 acres of irrigable land, through diversion and lateral canals, down to the farm units.

Now, gentlemen, it may be of interest to compare the length of this main canal, 9-miles, with the proposed length of the gravity canal, which was to be 130 miles. The capacity of the two canals would be practically the same. The gravity canal involved a number of tunnels and crossings of unusual magnitude.

The entire pumping project is altogether feasible from an engineering as well as from an economic point of view. The construction of this combined power and irrigation project will result in the production of more than 1,000,000 horsepower of continuous hydroelectric power or 2,100,000 installed horsepower, which power will be available for commercial sale in such a manner as to produce sufficient revenue to repay all the construction costs of the dam and power plant, with interest, and to reimburse the Government for at least one-half the construction cost of the irrigation project. As I explained previously, the balance of the cost of the irrigation features can be paid by the water users.

In addition to this, and what is most important, the surplus or secondary power will be sufficient to take care of all the pumping which will be necessary to meet the requirements of irrigation. From studies of the power market in the Northwest, the power from the project can be absorbed in the market in about 15 years after the dam and power plant are completed, provided the power companies, the municipalities, and other large users of power avail themselves of the cheap power that will be made available. It will take about 10 years to complete the dam and power plant and thus make the power available for sale.

The Grand Coulee power is, beyond question, the cheapest large block of power in the United States. In our studies we have assumed that from one-third to one-half the total increasing requirements for the State of Washington, the northern half of the State of Oregon, the northern part of the State of Idaho, and of that section of western Montana now served by the Thompson Falls plant would be supplied by power from the Grand Coulee Dam within the 15-year period.

Gentlemen, I will state that during this investigation we were in close touch with the power companies and they were kind enough to give us full and complete information.

Mr. SMITH. You were not being antagonized by the power companies in this project?

Major BUTLER. Not directly, sir. If the Government or any other agency can show the power companies that they can get cheaper power from Grand Coulee than they can produce themselves, it would be simply a good business policy for them to fall in line and take the power.

Mr. SMITH. That was our experience with the Boulder Dam situation. We had representatives of the power companies here who were opposing the legislation and in one instance they stated that they would build the dam, if they could have the power, and it would not cost the Government anything at all, as far as the construction work was concerned; and then later, when they saw the bill had actually become law, they took advantage of the opportunity of getting power, probably cheaper than they could have built the dam and furnished it themselves.

The CHAIRMAN. Now, Major, right on that point, do you understand that the Government can produce power cheaper than private power companies, and if so, why? Do you understand the question?

Major BUTLER. It can, Mr. Chairman, by using this particular power site. I would not say that the Government could do it cheaper than any private power company anywhere, but I will say this, that I doubt if you could prevail upon any power concern to go ahead with a development like this because it is so great in size and cost.

The CHAIRMAN. First, because of the tremendous investment?

Major BUTLER. Yes; it is too great for any private enterprise to undertake.

The CHAIRMAN. And if I understand your position on the particular site at Grand Coulee, the natural conditions there give such a tremendous advantage——

Major BUTLER. That is right. You can develop power on a large scale cheaper than you can on a small scale; and it is simply by building this enormous dam there and by utilizing the enormous storage of water made possible by the construction of this dam that you can get the cost of power down very much cheaper than anything with which I am familiar.

Mr. HALL. Well, I presume this matter of these physical facts have been brought out in your report. I have not examined your report thoroughly, but just a part of it. I would like for the members of this committee who have not seen the site to be told of the physical conditions with reference to transmitting that water down the Grand Coulee. I do not mean to bring it out now, but we can do that later in the hearing. I only make that suggestion because I think it would be very helpful to the members of the committee who are not so familiar with it.

Now you may proceed. I did not mean to interrupt your remarks.

Major BUTLER. I am very glad indeed to give any information I can with reference to the project.

The CHAIRMAN. Before we conclude I would like to have that done, though.

Major BUTLER. Mr. O'Sullivan has tacked on the wall an enlarged photograph of the site at Grand Coulee. I have the same thing here on a small scale. I also have a picture showing the bed of Grand Coulee. The walls are from 400 to 600 feet high and the

coulee bed is from 2 to 6 miles wide and 30 miles long. I also have a picture of a portion of the Rock Island development, recently completed.

Now, gentlemen, we were very much concerned in our studies about the economic feasibility of this great project and to determine that question, as well as to make certain about the engineering features, I would like to say that we went the limit. Although we had at our disposal many previous but incomplete surveys by able engineers, we took nothing for granted and left nothing untested. We had at our disposal ample funds and actually spent on the work $316,441.45. I think I may say, without exaggeration, that we gave this project the acid test. We did not hesitate to call in the best talent we could find to assist us in solving the many engineering, geological, and economic matters involved.

The CHAIRMAN. Major, I see a photograph here of the Washington Electric Power Co.'s plant at Wenatchee. I would like to get an idea of the distance from Grand Coulee up to Wenatchee.

Major BUTLER. I think it is about 70 miles.

The CHAIRMAN. Do you desire, Major, to file these photographs with the committee?

Major BUTLER. I will be very glad to leave the photographs; yes.

The CHAIRMAN. I will ask the reporter to mark them as exhibits in your testimony.

(The photographs were marked "Exhibits 1, 2, and 3," and were placed in the files of the committee.)

Major BUTLER. I also have some plates and maps here that may be of interest.

The CHAIRMAN. Major, I regret to have to interrupt the very illuminating and interesting statement, but to-day is our memorial day and I believe, Judge Hill, that we meet at 11.30 do we not?

Mr. HILL. I thought it was 12 o'clock.

The CHAIRMAN. I think the program begins at 11.30.

Major BUTLER. We meet promptly at 12, Mr. Chairman, but they commence to gather at 11.30 and the music starts. I think we ought to adjourn before 12 o'clock.

Mr. CHAIRMAN. I rather think it is wise to adjourn at this time. By the time we get over there, it will be past 11.30. You understand, Major?

Major BUTLER. Surely, sir. I am here at your service.

The CHAIRMAN. We will therefore adjourn this meeting until 10 o'clock Friday morning.

(Thereupon at 11.20 o'clock a. m. the committee adjourned to meet at 10 o'clock a. m., on Friday, May 27, 1932.)

THE COLUMBIA BASIN PROJECT

FRIDAY, MAY 27, 1932

HOUSE OF REPRESENTATIVES,
COMMITTEE ON IRRIGATION AND RECLAMATION,
Washington, D. C.

The committee met pursuant to adjournment, at 10 o'clock a. m., in the committee room, No. 333 House Office Building, Hon. Robert S. Hall (chairman) presiding.

Present: Representatives Hall (chairman), Cross, Gasque, Fulbright, Chavez, Miller, Overton, Martin, Smith, Leavitt, Swing, Arentz, Butler, and Loofbourow.

The CHAIRMAN. The committee will come to order. We will resume the hearings on H. R. 7446. When we adjourned the day before yesterday, Major Butler has not concluded his statement. The major is present and he will resume with his testimony.

STATEMENT OF MAJ. JOHN S. BUTLER, CORPS OF ENGINEERS, UNITED STATES ARMY—Continued

Major BUTLER. The chairman of this committee has asked why it is possible for the United States Government to produce cheaper power at the Columbia River-Grand Coulee site than can be produced elsewhere. The reasons for this are as follows: First. If the work is to be undertaken by the Federal Government, cheaper money can be secured. In our financial set-up Government money at 4 per cent interest per annum was considered, while for construction by private interests it was assumed that 6 per cent interest would be charged against the project. Second. The magnitude of the project makes it possible to reduce unit construction and operating costs. Third. The Columbia River-Grand Coulee site lends itself admirably to the production of cheap power on a large scale. Furthermore, the combination of the power development and the irrigation project works out in a highly satisfactory manner. The demand for a large block of cheap power for pumping to meet the irrigation requirements is highly desirable in utilizing to the fullest extent the output of the power plant. Likewise, the settlement of over 1,000,000 acres of irrigable land will necessarily increase the demand for this power. Fortunately, the demand for power for irrigation pumping comes at a time of maximum flow of the river and likewise maximum production of power.

The Bureau of Reclamation has reviewed the report of the Corps of Engineers on the Columbia Basin project. They have indorsed the report and are in substantial agreement with it. In a recent letter to the Chief of Engineers, Corps of Engineers, United States

Army, concerning this report, Dr. Elwood Mead, Commissioner of Reclamation, says:

> The only portion of the investigations dealt with in this report which concerns the work of the Bureau of Reclamation is that relating to the utilization of the river at Grand Coulee through the construction and operation of power and irrigation works. With your conclusions regarding this I am in accord, and it is a pleasure to be able to state that there is a complete agreement between the engineers of the War Department and those of this bureau regarding the plans which should be adopted for irrigation and power development and the estimates of cost.

One of the members of this committee has asked about the characteristics of the Columbia River-Grand Coulee Dam and Reservoir site, and their suitability for the purposes intended. This is a very interesting and also an extremely important question since it has to do with the engineering feasibility of the combined power and irrigation project. The foundation of the dam proper will be on solid granite about 60 feet below low water in the river as disclosed by diamond drill borings.

General MARTIN. You have to go down to 60 feet for your foundation?

Major BUTLER. That is, 60 feet below the low water level of the river, to granite bedrock.

General MARTIN. You have to go that far down?

Major BUTLER. Yes. That is really one of the few places on the Columbia River where the bedrock, in this case granite, approaches that close to the surface.

The abutment walls are likewise of solid granite. Certain portions of the exposed surfaces of the abutments show signs of disintegration, but this is to be expected, and the estimates provide for the removal of all unsatisfactory material. On the whole this is an excellent dam site and it lends itself to the combined plan in a highly satisfactory manner.

It is rather a remarkable coincidence that this excellent dam site should be located at the point where the Columbia River intersects the north end of the Grand Coulee, a natural channel from the river to the Columbia Basin lands.

A very thorough investigation of the suitability of the Grand Coulee floor as a reservoir site was made. The section of the Grand Coulee that it is proposed to utilize for this project is from 25 to 30 miles long and from 2 to 6 miles wide. Its basalt walls have been ground down by glacial action from four to six hundred feet in depth. Since the bed of this coulee is about 600 feet above low water in the Columbia River, the ability of this coulee to hold water in storage without excessive leakage is a very important question. Test holes were dug and drilled at various places, the location of springs and the levels of ground water were studied, as were many other questions relating to this subject. Outstanding engineers and geologists were employed to make a thorough investigation of this subject as well as of all other important questions having to do with the engineering and economic feasibility of the entire project. It was the consensus of opinion of these experts that the sites proposed were entirely satisfactory to meet the requirements for safe construction.

Reference is invited to Plates 57 and 58 herewith, marked "Exhibits 6 and 7," which show the general plans and sections of the dam and power plant at the Grand Coulee site as proposed by the Corps of

Engineers. If any of you are interested, gentlemen, I would be very glad to pass these plans around.

General MARTIN. These will be in the main report, of course?

Major BUTLER. They will be in the main report, but for the purpose of illustration, I am pointing out a few of these plans. A map of the Seattle district showing the comprehensive plan for the proposed improvement is shown herewith on Plate 146, which is a part of this report. (See Exhibit 4.) Plate No. 147 is a profile of the river showing the comprehensive plan. (See Exhibit 5.) This profile is the same as the one that is on the wall.

The unit costs of the production of power at the Columbia River-Grand Coulee Dam, under certain conditions, are shown on plate 60 herewith. (Exhibit 8.) For a 60 per cent annual plant capacity factor, the cost of generating power per kilowatt-hour is 1.14 mills with 4 per cent money and 1.71 mills with 6 per cent money. The cost of generating steam-electric power with oil at $1 per barrel would be about 4.3 mills per kilowatt-hour. (See p. 332 of the report on the upper Columbia River by the Corps of Engineers.)

The annual output of power at the Columbia River-Grand Coulee Dam, based upon power available 90 per cent of the time, will be 947,419 kilowatt-years. The output in kilowatt-hours will be approximately 8,300,000,000.

The results of our power market studies showing the trends in the generation and utilization of power are given on Plate 125 herewith. (Exhibit 9.) This plate shows the rate of growth from the year 1905 up to 1930. Then our predictions as to future growth up to 1960 are shown. The plate shows that the rate of growth in the market area tributary to the Columbia River-Grand Coulee Dam site for the period mentioned averaged 9.5 per cent compounded annually. In making our estimates for future growth, we assumed that this rate of growth would gradually decline until it reached a rate of increase of but 4.75 per cent in 1960 and zero per cent by 1990. In my report, I suggested that no construction work should be undertaken until the Government had obtained full and complete assurance that this power could be absorbed into the market without any bad effect on the power situation. (See par. 1033 of report.)

Mr. CROSS. You stated a moment ago that you had access to the records of the power companies in order to find out how much it cost to produce power per kilowatt-hour. How does their cost compare with the cost here?

Major BUTLER. We secured from the power companies the output of their various plants by the month and year in kilowatt-hours. And while we did not secure any direct information from them as to their unit costs of production of power—the power companies naturally prefer not to give out such information—we had means of arriving at satisfactory estimates of their costs and as a result we believe that this power at the Columbia River-Grand Coulee Dam can be produced much cheaper than elsewhere.

Mr. CROSS. Do the companies keep that information hidden, as to what it costs them to produce power in that section? Have you no way of finding out what it is? You do not know what it is?

Major BUTLER. I do not know what their cost records show. It is really quite difficult to get right down to their actual costs. But there are certain well-known factors that enter into the cost of pro-

duction of electricity. These factors are more favorable for the generation of cheap power at the Grand Coulee site than elsewhere. This cost as shown on this chart is very much lower than such costs usually run. That is my opinion and that is based on our best estimates of cost.

The CHAIRMAN. Can you give us some information as to why it is that power can be produced more cheaply on this project than it is now being produced?

Major BUTLER. Because of lower interest charges on Government money, because of the large-scale production, and because of the very favorable site, as has been explained.

This cost that I give here is the actual cost at the plant. Of course, we made a study of the cost of transmitting that power from the plant to distances of 100, 200, and 300 miles. We went into that phase of the study very carefully. Our study showed that power generated at the Columbia River-Grand Coulee site can be placed in Seattle, in Portland, and in Spokane at a cost, even after having been transmitted 200 miles, less than it can be produced by steam. I am sure that any authority on the production of power—we have two of them here to-day—will bear me out in the statement that the cost of producing power by steam has been very much reduced in recent years. Notwithstanding that, I feel safe in saying, as our studies show, that we can place this power on the market, after paying from one-half to three-quarters of a mill per kilowatt-hour for transmission, cheaper than it can be produced locally by steam.

General MARTIN. What the judge wanted you to point out, Major Butler, were the reasons why this power can be produced so much cheaper by the Federal Government. You can summarize those reasons succinctly, can you not?

Major BUTLER. I tried to do that in previous statements.

General MARTIN. In the first place it is a matter of quantity production; you have mass production?

Major BUTLER. That is one of the items; yes.

General MARTIN. The next thing is that the Government does not have to pay commissions to private interests or that private interests would have to pay to get the money?

Major BUTLER. That is correct.

General MARTIN. And the Government can amortize the bonds and does not have to pay interest on them year after year, as private owners do, to those who buy them as investments?

Major BUTLER. That is correct.

General MARTIN. And the Government does not pay taxes?

Major BUTLER. That is a very important item—taxes.

General MARTIN. The judge wanted you to state succinctly why it was that the power could be produced more cheaply by the Government there than otherwise.

Major BUTLER. I tried to bring that out. The first point was that if the Government undertakes this project, the interest on Government money used in construction would be at a very much lower rate than money invested by private enterprise.

General MARTIN. And the Government would not have to pay commissions to get that money?

Major BUTLER. That is correct. The carrying charges would not be so great. We figured on 4 per cent for Government money and 6

per cent for private money. The difference is shown on this chart here [indicating on the chart]. The cost here is 1.14 mills per kilowatt-hour for 4 per cent money and for 6 per cent money it is 1.71 mills. That is rather a startling difference.

Mr. SMITH. You have stated that the energy could be delivered to certain points, but that you do not contemplate doing that; that the electric energy would be sold to distributing companies?

Major BUTLER. That is not a matter for the engineers to decide. In our calculations, we figured the cost at the switchboard of the power house, and we figured the cost of transmission, in order to determine if this power could be marketed in competition with other power.

General MARTIN. Of course, that is where the big question comes in. One side of this is for the Government to sell it to distributing plants at the switch and the other is to build trunk lines into the different territories and sell it that way. The extreme element wants to enter into the distribution of it generally.

Mr. ARENTZ. Depending upon whether there is a financial possibility for success or not. It depends upon whether it can be delivered regardless of who delivers it. They are not contemplating that the Government will deliver it, but it must be delivered. If it can not be delivered at a certain price, it is not feasible.

Major BUTLER. Our story would not be complete had we not investigated the cost of delivering this power. As a matter of fact, the delivery of such large blocks of power over such distances is a big and difficult problem, without precedent. We had to get a specialist, a man who was an expert on that particular phase of the subject, to figure out the cost of transmitting the power. It is a very involved question and it is one on which we went to great lengths to get information, because we felt it was quite important. We are not concerned about who delivers the power, but we want to be able to say that it is feasible to put this power in Seattle and Portland and Tacoma and Spokane at a price with which the local power interests can not compete. That simply means that if this project is ever undertaken by the Federal Government the local power people will be forced to recognize that power.

Mr. ARENTZ. You have a measuring stick there in the fact that if the figures arrived at for transmission of the Boulder Dam electricity had not been agreed on by the power companies, they would never have bid for the delivery of that power at Los Angeles or any place else. In other words, that was the measuring stick?

Major BUTLER. Yes.

Mr. ARENTZ. They agreed that the figures arrived at by the Government for transmission costs were pretty nearly correct.

Major BUTLER. Gentlemen, Mr. McClellan, chief electrical engineer of the Bureau of Reclamation is here to make a statement. As a specialist on the purchase and cost of power he is probably more competent to discuss this question than I and I shall be very happy to have him take up these matters in detail at the proper time.

Mr. CROSS. You said that the distance from this proposed dam to Seattle and these other places is two hundred and some miles?

Major BUTLER. The distance from Seattle to Grand Coulee is about 165 miles on an air line.

Mr. CROSS. How far is it now from Boulder Dam to Los Angeles?

Mr. MCCLELLAN. Two hundred and thirty-five miles.

Mr. ARENTZ. Mr. Cross, at the present time we have lines in northern California and southern California tied together. If there is a heavy cold spell in northern California, in the Sierra Nevadas, and the amount of water is less than it should be to provide the necessary power, the lines are tied in and you have not only 235 miles over which to transport this electricity, but it is nearer 350 miles. Of course, whether it is economical or not, is a question.

Major BUTLER. Yes; you are simply pumping it into one point on the system.

Mr. ARENTZ. But you must have a system in which there is some elasticity. If you do not have that, you can not get along very well.

Major BUTLER. In our report we have gone into the distribution of power in the area tributary to the Columbia River-Grand Coulee Dam site quite fully. I refer to page 491, paragraph 857, part 2 of the report on the Columbia River, also to plate 114.

Mr. ARENTZ. You may have a line going out and it is necessary, in order to keep up the supply, to shift it from one place to another.

Major BUTLER. The estimates of the Bureau of Reclamation went so far as to provide auxiliary steam plants along the main lines of Grand Coulee transmission so that if even one of these power lines went out, there would be auxiliary power there to take care of the situation. It is really the businesslike thing to do. You have to look out for these contingencies.

One thing that would save a lot of that expense, I would say, would be a superpower network. I think in that case you are not so likely to have to resort to those extreme means. Is not that right, Mr. McClellan?

Mr. MCCLELLAN. That is right.

The CHAIRMAN. Major, do you desire to leave the blue prints with the committee?

Major BUTLER. Yes, sir. I have a list of them here and will leave them with the committee.

The CHAIRMAN. We will have them marked as exhibits in your testimony.

Mr. ARENTZ. Mr. Chairman, you are just going into the power phase of this question now. There is no use muddying the waters by going into anything else now.

The CHAIRMAN. Congressman Hill is presenting the testimony and he can state better than I the procedure.

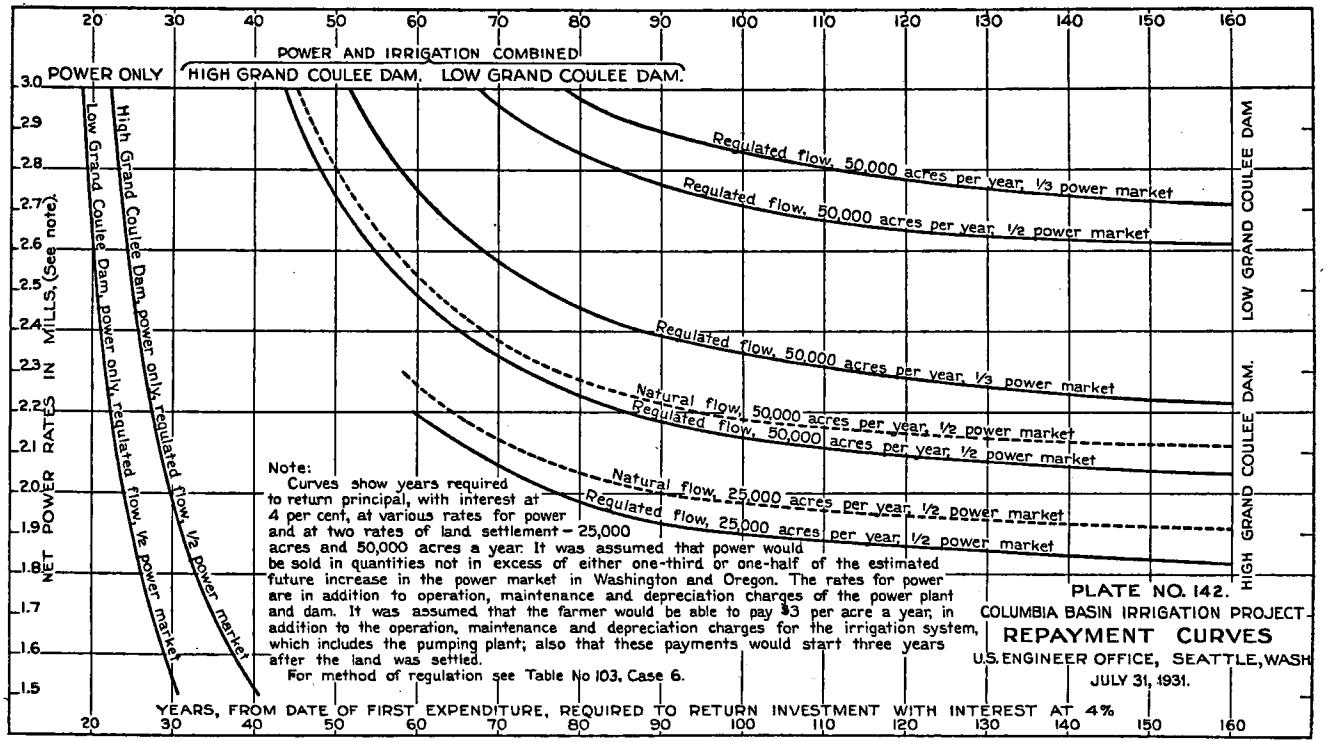
Major BUTLER. I have only a few more remarks, gentlemen, and then I will be through.

Mr. CROSS. I would like to ask you a question with reference to these costs. Have you an idea, if you sell this power to these companies, what they will pay for it at the switch?

Major BUTLER. I should say between 2 and 3 mills per kilowatt-hour. These prices, plus the cost of transmission, would be less than what they can produce power by steam and should prove sufficiently attractive to induce them to purchase power at the Grand Coulee.

Mr. CROSS. You gave some figures of 1.1 mills and 1.7 mills, depending upon whether you have 4 per cent money or 6 per cent money.

Mr. ARENTZ. Mr. Cross, I think that is 0.0017 mill. You get down into very small fractions there.



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Major BUTLER. Gentlemen, I have some curves here which I thought were very interesting. They are what we call the repayment curves. (See plate 142.) For instance, with power selling from 1½ to 3 mills, the curves show the number of years in which it would be possible to make payments on the investment. These curves show that if the power is sold for 2 mills, net, or about 2.1 mills gross per kilowatt-hour at the switchboard of the Columbia River-Grand Coulee Dam, it will pay for the high dam and power plant, plus 4 per cent interest, in 30 years.

Mr. SMITH. Mr. Chairman, I have not been able to attend these sessions continuously, but if this information has not been furnished by the major, I would like to ask him a question. What progress has been made, if any, toward extending the proposed market for this power over a lapse of years?

Major BUTLER. We have gone into that study quite carefully and the results are shown on this chart [indicating]. According to the records of the United States Geological Survey, here is the production or output of power for the entire United States beginning with the year 1905 and running up to 1930. The curved line there shows an average yearly increase of 9.6 per cent compounded for the entire United States. For the Pacific coast the rate of increase was 9.7 per cent annually. For the Columbia River market area, the chart shows a rate of increase of 9.5 per cent compounded annually. The rate of increase for the western part of the State of Washington was 10.8 per cent and for the eastern part 7.5 per cent. Now, from this information and from other information that we obtained, we derived a curve for the purpose of showing what the growth of the market would be in the future. This curve was worked out in a very careful way. According to the curve [indicating], we estimated that the rate of growth, beginning at 9.5 per cent in 1930, would gradually decrease to a rate of increase of 4.75 per cent by 1960 and thereafter would continue to decrease until it reached zero by 1990.

Of course, this is simply our prediction, based upon the best information obtainable, of what is going to occur. Nobody, I think, knows what the future is going to bring forth. There may be developments that will change the situation altogether, but from the best information that we have this chart shows the trend in the growth of the power market in that section.

The Bureau of Reclamation, I believe, worked up curves of the Northwest power market independently, and arrived at practically the same conclusions as we did. They were probably a little more pessimistic than we were.

Mr. MCCLELLAN. A little more conservative.

Major BUTLER. Well, we thought we were conservative, but their estimated rate of growth was, perhaps, just a little more conservative.

Mr. ARENTZ. Have you touched on the absorption period at all?

Major BUTLER. We estimated that the power generated at the Grand Coulee would be absorbed in about 15 years after the completion of the dam. In order to arrive at that figure, it was assumed that one half the estimated future increase in the demand for commercial power in Washington, the northern half of Oregon, the northern part of Idaho and a section of northwestern Montana would be supplied from the Grand Coulee plant.

Mr. MARTIN. And the other half would go to irrigation?

Major BUTLER. No, sir. This [indicating on the chart, plate 125] is the entire power market for that vicinity. The other 50 per cent of the power would be produced by private or municipal interests in a smaller way, in smaller plants. It must be remembered that this power that we are discussing will be new power and will be in addition to the power now produced or that will be produced by the time the Columbia River-Grand Coulee dam and power plant are completed.

Mr. MARTIN. You made a very thorough investigation of the cost of power. Now, you are going to have to meet certain objections which I would like to have you answer now.

Mr. ARENTZ. If we are going to have those questions we might just as well have them answered now. We are going to face them anyway.

Major BUTLER. As I said before, Mr. McClellan, who is chief electrical engineer of the Bureau of Reclamation, is here to make a statement. It will facilitate matters if we leave these questions to him to answer. Otherwise, we will have to go over the same ground again.

Mr. ARENTZ. For instance, Major, in the matter of a fraction of a mill, what will the interest over this absorption period amount to per kilowatt-hour in fractions of a mill?

Major BUTLER. Our electrical experts worked that out, but I have not that data with me at this moment.

Mr. ARENTZ. That is all right, Mr. McClellan can give it to us later on. We might just as well face these questions now as later.

Mr. MARTIN. I do not know whether I can state this exactly or not, but it is another thing that we have got to face. I have been told by very distinguished engineers that the cost of producing electricity by steam has been reduced so much that they can produce it cheaper, or eventually will be able to produce it cheaper with improved machinery, than you can produce it at these hydroelectric plants. What investigation have you made along that line?

Major BUTLER. As I stated a few minutes ago, the cost of producing power by steam has been very materially lowered in the last few years.

Mr. MARTIN. And it is going down all the time.

Major BUTLER. It can not keep going down beyond a certain point.

Mr. MARTIN. Where they build these plants at the mine and avoid the cost of transportation of coal and where they have this cheap oil piped to these plants, what are the comparative costs?

Major BUTLER. General, I have already shown that steam power, with oil at $1 per barrel, can not compete with Grand Coulee power, even if the latter power has to be transmitted a long distance. I have in my hand a curve prepared by the Corps of Engineers showing the cost of producing steam electric power with oil at $1 per barrel.

Mr. MARTIN. But how about oil at 10 cents?

Mr. ARENTZ. In five years you are not going to face oil at $1 a barrel. We have got an asset here that the United States is not going to see wasted. You are going to see oil at $1.50 a barrel. People are not going to dissipate their natural resources.

Mr. CROSS. Have you any figures showing the depletion of the oil supply, or the probability of its depletion? For instance, take the fields in Texas that I know something about. We strike a rich field. We have gushers and in a little while they become pumpers and then

in a little while after that they are almost played out. Of course, you can keep on adding fields here and there, but have there been any estimates made when that will become exhausted finally?

Mr. ARENTZ. In other words, Mr. Cross, it has been a miracle that over a period of five years peak production has been reached at the same time in a number of new areas. How long is that miracle going to continue? It may stop next year. If it does, you are going to have pumping instead of natural flow and if that happens, you are going to have a higher price for oil, that is all.

Major BUTLER. Gentlemen, I would like to say that in a certain section of this report of the Corps of Engineers, we did go into the question of the available natural resources as far as we could. It is a very broad subject. For instance, we went into the question of the production of aluminum and various steel alloys to try to show the possibility of increasing the demand for electric power. But it is a very broad subject and I can not say that we have anything very tangible in our report that goes into the depletion of your oil fields. It is quite difficult to tie that into the practical question at this time. There is a lot of room for your imagination in that question. We have tried to eliminate that feature from our report as much as possible.

Returning to the question of General Martin concerning the relative costs of steam and hydroelectric power production, let me say again that plate 60 shows the cost per kilowatt-hour of producing power at Grand Coulee, also the cost of producing steam power with oil costing $1 per barrel. With an annual plant-capacity factor of 60 per cent and with 4 per cent money the cost of Grand Coulee power will be 1.14 mills; with 6 per cent money, it will be 1.71 mills per kilowatt-hour. For steam power, with fuel oil at $1 per barrel, the cost is four and three tenths mills per kilowatt-hour.

Mr. MILLER. Is it not a fact, as a matter of practical application, that where hydroelectric power is available for distribution, but the distributing company has not the experience from past years of operation, the distributing company can buy the power more cheaply from the dam than it can produce it by steam or otherwise, and that the only advantage of maintaining these plants is for emergency purposes?

Major BUTLER. Largely for that purpose.

Mr. MILLER. Just as a matter of actual practice, I know that is our experience in our State; in the State of Arkansas. We have dams down there and that is our experience. I happen to know a little something about our actual experience. I am not so much interested in the actual cost in mills, but I am interested in the actual, practical application of this matter.

Major BUTLER. As a matter of fact, the power companies that have had good hydroelectric developments have been using these plants all the time, at least up until the depression. Some of them have had steam stand-by plants. The Puget Sound Power & Light Co. have lately completed a 70,000-kilowatt steam plant in Seattle, one of the finest in the country and one of the most modern where they can produce power probably as cheap as at any other steam plant in the United States. They have a choice of using hogged fuel (wood chips), or oil by ship at their dock or coal from near-by mines. And

yet this steam plant is never used except as a stand-by plant. It is used only when there is a lack of water or in other words a lack of hydroelectric power.

Continuing with my statement, gentlemen, project repayment curves are shown on Plate 142. They are rather interesting curves. They show, as I stated before, that with a high dam in the Columbia River at the Grand Coulee, if you can sell your power for 2 mills, net, the power will pay for the dam and power plant, with interest, in 30 years.

With a combined power and irrigation project, with the high dam in the Columbia River at the head of the Grand Coulee, with a rate of settlement of 25,000 acres per year, and with the power selling for 2.2 mills per kilowatt-hour, net, or about 2.3 mills gross, the curve shows that the returns can be made on the entire investment, both the power and irrigation development, with interest at 4 per cent in 60 years. If interest is not charged on the irrigation project, the power revenues will pay about half of the irrigation costs, the balance being paid by the settlers.

Mr. CROSS. I am ashamed to admit that I have not been here at all of the hearing, but what is the acreage that could be irrigated?

Major BUTLER. What we call our combined power and irrigation project provides for putting water on about 1,200,000 acres.

Mr. SUMMERS. Beginning when, Major?

Major BUTLER. That, I would say, would depend on Congress. Ten years was assumed as the time necessary to prepare working drawings of the dam and power plant and to construct the same. Fifteen years was assumed as the absorption period for the commercial power. We recommended in our report that the irrigation part of the development be delayed until conditions fully warranted it. Normally—and I think the irrigation people will bear me out in this—the faster you can settle your irrigation project, the better it is financially. It is just the reverse in this case. The slower you can settle it, the better it is financially. The longer you put off the irrigation part of the development, the better the project is as a financial enterprise.

Mr. SUMMERS. That is because of the consumption of power and the liquidation of costs?

Major BUTLER. Yes, sir. It is simply due to the fact that irrigation, when considered alone, will not carry the full burden. Power must help carry the irrigation costs. The longer the power revenues can be applied on paying for the cost of the dam and power plant, the more money there will be available to cut down the cost of reclamation.

Mr. ARENTZ. I notice, in this (H. R. 7446), that the Secretary of the Interior, in his discretion, can attribute a certain amount of the cost to flood control, and of course that will be the contribution of the Government to that development. Have you got any figures on that?

Major BUTLER. No, sir.

Mr. SMITH. As a matter of fact, there is no flood out there, is there?

Major BUTLER. We have no flood problem on the upper Columbia River except in a very indirect way. I pointed out to you the possibility of that.

General MARTIN. The freshets in the spring have a very bad effect.

Major BUTLER. Gentlemen, you have a different situation on the lower Columbia.

General MARTIN. They have floods up in Wenatchee, too, as they run off in the spring. I understand that during the big flood of June, 1894, the flow at Rock Island, 12 miles below Wenatchee, reached 740,000 second-feet; that the river, at that point, raised better than 40 feet above low water stage and that as a result the water flooded part of Wenatchee, covering railway tracks and the floor of the Great Northern depot.

Major BUTLER. Those floods are not disastrous, since the river gorge is entirely sufficient to carry the flood waters.

There is a flood problem on Flathead Lake. There is a possibility of storing 1,100,000 acre-feet (effective) in a place called Hungry Horse Rapids on the south fork of Flathead River.

General MARTIN. Up in Montana?

Major BUTLER. In Montana; yes. That storage will be beneficial to the floods on Flathead Lake. The people lower down on Lake Pend Oreille have a similar flood problem.

Mr. MILLER. Would you think it would be advisable to strike that provision from the bill?

Major BUTLER. I would not like to say that.

Mr. MILLER. The point I was getting at was this; it would probably be an impediment to the passage of this bill if we have to leave in the bill the open question there as to what money the Secretary, in his discretion, may say should be charged to the Government as it's contribution to the project.

Mr. MARTIN. I think probably we should put in a saving clause; but before expressing the opinion, I would be very glad to get your views. Perhaps Judge Hill could explain it.

Mr. LEAVITT. Have the Army engineers made a report on it?

Major BUTLER. We have covered it to the extent of saying there is no serious flood problem on the upper river.

Mr. LEAVITT. That more or less covers it, does it not?

Major BUTLER. Yes.

Mr. CROSS. Would it be any assistance to the lower reaches in floods?

Mr. LEAVITT. That is the point. There was a question asked over there; do they, in their report, say that the control of the floods on the upper reaches of the river would be beneficial to the control of floods lower down in the navigable part of the river?

Mr. MARTIN. In other words, the runoff—the trouble we have in the Snake and the Columbia coming out together, and we have had some enormous floods.

Mr. LEAVITT. I was wondering if the Army engineers were going at this—whether they are leaving it out and saying it has no flood control value, even though it may add to the difficulties lower down on the river.

Major BUTLER. I will say this: As far as the upper river is concerned, I made the statement in the report that flood control for that particular section of the river was of no importance, no great importance.

Mr. ARENTZ. We must measure the benefits that will be derived from this storage to the lower reaches of the river, just the same as you would in the storage of the upper Missouri or the upper Arkansas, and that it would have it's effect upon the levee districts from Cairo, Ill. to the Gulf.

Mr. LEAVITT. Might I ask this direct question: Would the building of the Hungry Horse storage and the storage in the lower lake be beneficial in controlling the floods of the navigable part of the Columbia River?

Major BUTLER. We made a very detailed study of the effect of 1,100,000 acre-feet of storage at Hungry Horse and the effect it would have on Flathead and Pend Oreille Lakes. The best benefit we could get on Flathead Lake would be 2 or 3 feet lower level during the floods. That would be achieved by setting aside at Hungry Horse a certain amount of water for flood storage purposes. Now this storage would affect Lake Pend Oreille in a lesser degree and the effect on the main stream of the Columbia, even in the lower section, would not be very large.

However, there is one point, and that is this; the storage behind the dam in the Columbia at Grand Coulee, 5,000,000 acre-feet, and the storage that will be available from the construction of the series of dams down the river, would have some effect on the situation in the lower river; and I think it is well enough for those things to be taken into consideration.

Mr. LEAVITT. You would not want to leave it out of the bill, then; you would not recommend leaving it out?

Major BUTLER. No; I would not like to take the responsibility of saying it should be left out.

Mr. MILLER. I am not wanting it stricken out, but I want to have some information, if we could get it, as to what possible provision there is that the Secretary of the Interior can determine the proportion of the cost which properly shall be charged to flood control.

Major BUTLER. I am not prepared to give this information at this time further than has been already discussed. If you will permit me, I will now summarize my statements as follows:

The effect of upstream storage on the tidal section of the Columbia River, if anything, will be small. However, when combined with large storage from power dams on the main stream and on the Snake River, the effect may be materially beneficial.

This question has been treated fully in the lower-river report by the Portland district engineer and it is beyond the scope of the Seattle district report.

This question, as far as it pertains to the upper Columbia River, has been discussed in the report of the Seattle district engineer on the Columbia River above the mouth of the Snake in paragraphs 1039 to 1061 and in paragraph 1999, page 909. (References to the above report heretofore or hereafter given refer to the typewritten report and not to the printed report, which is not yet available.) Reference is also made to the reports of the Portland district and division engineers and to the letter of the Chief of Engineers, Corps of Engineers, War Department, dated March 29, 1932, and already introduced in my statement.

Gentlemen, I have a very interesting chart here (pl. 144), entitled "Analysis of probable results of agricultural production" on the Columbia Basin irrigation project. This chart is the result of an economic analysis of the probable effect of agricultural production from this project and shows the indirect benefits that will result from the development.

Mr. SUMMERS. Mr. Chairman, will the major yield to me for a few questions at this point? I would say to the committee that the Grand Coulee power plant and the irrigation project that is to follow

are within the districts represented by Judge Hill and myself, and we are equally interested, and there are a few points that I would like to have placed in the record consequentially. So, Major, I would like to ask you this question: Is the engineering data complete for the beginning of the construction of the power plant?

Major BUTLER. My answer would be no. I would like to say—and I am expressing the opinion of the Chief of Engineers when I say this—that we have given all of the data necessary for Congress to arrive at a conclusion as to the best plan and a decision favorable to authorization, if, in its judgment, it is desirable to go ahead. We have, in effect, said to Congress: This project is feasible from an engineering standpoint and it is feasible from an economic standpoint under certain conditions; the data we have gathered have been sufficient to warrant these conclusions; if Congress, acting upon the facts we have gathered and the conclusions we have reached, should authorize this project, it will then be necessary to do some preliminary work before construction is undertaken.

Mr. SUMMERS. Would not the working plans, the final details for the actual construction, have to be worked out?

Major BUTLER. Well, we have gone into it far enough to get up very complete general plans in order to determine the feasibility and to enable us to prepare careful estimates.

Mr. SUMMERS. Then, may I ask the question in this way: What is lacking—some of the technical details?

Major BUTLER. Well, while sufficient diamond drill borings have been done in the Columbia River at the Grand Coulee dam site to satisfy us that the foundations for the high dam are excellent, further borings will be necessary to determine the exact contour of the surface of the granite bed rock before the working drawings of the dam can be made. Before reclamation is started, there will be needed detailed topographical and soil surveys of the irrigable land to determine more in detail the classification of the land and the final working plans for the canal, tunnel, and siphon structures. And while we have gathered sufficient of the above data for our purposes, further detailed information, as is natural, must be gathered before actual construction work is started.

Mr. SUMMERS. But you have demonstrated to your satisfaction the feasibility of the dam and power plant and the adequacy of the water supply and everything else of that kind?

Major BUTLER. Yes, under the conditions that we have stated.

Mr. LEAVITT. From an engineering standpoint you know that the proposed dam could be put there and it would stand?

Major BUTLER. Yes.

Mr. SUMMERS. What would be the height of the dam?

Major BUTLER. The average height of the dam above bedrock in the river would be about 430 feet, or about 370 feet above low water.

Mr. SUMMERS. And the length of the dam?

Major BUTLER. The length of the dam, on its crest, would be 4,290 feet. I might add, for your information, that the head of water, for power purposes, at low water, will be 354.6 feet.

Mr. SUMMERS. And it would take how long to construct?

Major BUTLER. About 10 years, sir.

Mr. SUMMERS. And the cost of construction?

Major BUTLER. Well, I think I have already given that.

Mr. SUMMERS. Well, Major, pardon me. I just want to get these points firmly established.

Mr. CROSS. I think he said $174,000,000 a while ago, or about that sum.

Major BUTLER. Yes, I gave you the cost at about $171,000,000 or to be more exact, at $171,187,000 for the high dam and the power plant, including interest charges during construction at 4 per cent.

Mr. SUMMERS. And it would produce how much power?

Major BUTLER. The annual power output, based upon our figures, is 947,419 kilowatt-years for 90 per cent of the time or about 8,300,000,000 kilowatt-hours per year. Now to get at it another way, the installed capacity figured on was 15 units of 105,000 kilowatts each, which will total 1,575,000 kilowatts. That would be the capacity of the plant or approximately 2,100,000 horsepower.

Mr. SUMMERS. How does this compare with other power plants in the United States, or two or three of the largest?

Major BUTLER. Well, I understand that the plant at Boulder or Hoover Dam will have an installed capacity of about 900,000 kilowatts or about 1,200,000 horsepower as compared to our 1,575,000 (installed) kilowatt plant or 2,100,000 installed horsepower. I understand that the output of firm power at Hoover Dam will be 4,300,000,000 kilowatt-hours per year as compared to our output of about 8,300,000,000. Hoover Dam power may be somewhat larger than given here through the plan to increase the height of that dam.

Mr. SUMMERS. How does this compare with Niagara?

Colonel COOPER. The total installed capacity at Niagara is about equal to that which will be installed at the dam in the Columbia at the head of the Grand Coulee.

Mr. SUMMERS. How does it compare with Muscle Shoals?

Major BUTLER. Colonel Cooper, who was consulting engineer for the Corps of Engineers on that project, can tell you that.

Colonel COOPER. Muscle Shoals, with full power installation, would produce about 35 per cent of the output at the Grand Coulee.

Major BUTLER. As I understand they have now installed at Muscle Shoals four 30,000 kilowatt units and four 36,000 kilowatt units.

Mr. SUMMERS. How does the Columbia River compare with some of the other rivers of this country? I find that there is much misunderstanding and lack of information as to that.

Major BUTLER. I would say, as far as power is concerned, it can not be surpassed by any river in the country.

Mr. MARTIN. The greatest power stream in the country?

Major BUTLER. Yes.

Colonel COOPER. Beyond any question.

Major BUTLER. It is a wonderful stream for the development of power.

Mr. MARTIN. You want to state it is the greatest.

Major BUTLER. I tried to be conservative, General; I want to keep both feet on the ground.

Mr. SUMMERS. What is the cost of power at the switch, with 4 per cent money figured on the investment?

Major BUTLER. At the proposed Columbia River dam site at the head of the Grand Coulee, with 4 per cent interest charged on the investment and with an annual plant capacity factor of 60 per cent, the cost will be 1.14 mills per kilowatt-hour.

Mr. SUMMERS. How does that cost of power at the switch compare with some of these other places that I have inquired about?

Major BUTLER. I would say that it would cost three or four times that much at some of the other places.

Colonel COOPER. That is a very difficult question to answer. Of course, it is so much lower at the Grand Coulee than it can be produced anywhere else in the United States, all comparisons are out of the picture.

Mr. SUMMERS. It costs, as I understand your statement, one-third or one-fourth of what it does at the other principal power producing sites?

Mr. MARTIN. That is a little bit too much.

Colonel COOPER. The most economical steam plant uses fuel at less than it is worth. These people who are talking to you about competition between this water power and their conception of steam, with fuel for nothing—why Columbia River power would be one-half the cost of what anybody could produce it by steam, even if the fuel cost nothing.

Mr. SUMMERS. Thank you. Now, I am not seeking to make invidious comparisons, but we do have to work this thing out for final consideration. What is the estimated cost of power at the switch at Boulder Dam?

Mr. MCCLELLAN. We are selling it for 1.63 mills per kilowatt-hour It will cost the electric utilities better than 2 mills because they will have to pay for the power machinery, etc. But that is not the cost; that includes enough return to repay the investment.

Mr. SUMMERS. How long would it require to construct the power plant?

Major BUTLER. About 10 years.

Mr. SUMMERS. How long to pay out at 4 per cent?

Major BUTLER. Thirty years.

Mr. SUMMERS. Paying 4 per cent interest on the money?

Major BUTLER. Yes.

Mr. SUMMERS. And the estimated annual returns from power?

Major BUTLER. I do not have that figure in mind.

Mr. SUMMERS. Will you have it put in the record?

Mr. MCCLELLAN. About $17,000,000 per annum.

Major BUTLER. That sounds reasonable.

Mr. SUMMERS. That is the estimated annual return from power?

Mr. MCCLELLAN. Yes.

Mr. SUMMERS. And it takes 30 years to pay out the cost of the dam and power plant, plus 4 per cent interest, after which the Government may expect a net revenue of $17,000,000 per annum?

Major BUTLER. Yes; it would take 30 years for the power revenues to pay for the construction costs of the dam and power plant, plus 4 per cent interest. It would take a longer period for the combined revenues from the power and the settlers to pay for the combined power and irrigation project.

Mr. SUMMERS. I take it that will be covered more in detail by the Reclamation Bureau?

Major BUTLER. Yes.

Mr. SUMMERS. I thank you very much, Major. I only wanted to get some of this data in concentrated form.

Mr. HILL. I would like to ask a question or two, following Doctor Summers, in order to get this data in compact form.

The CHAIRMAN. Go ahead.

Mr. HILL. You say it will require about 10 years to build the dam and about 15 years after the dam and power plant are completed to absorb the power?

Major BUTLER. Yes.

Mr. HILL. And at the end of 30 years from the date of the first expenditure on the dam and power plant, the returns from the power, if sold at 2 mills per kilowatt-hour net, or about 2.1 mills gross, assuming that the work on the dam and power plant are completed within 10 years and the power is absorbed within 15 years after the completion of the dam and power plant, will have paid for all construction costs of the dam and power plant, plus 4 per cent on the investment?

Major BUTLER. Yes.

Mr. HILL. Now, then, under the bill as redrafted, one-half of the cost of the reclamation of the arid land is to be paid from power. At the end of that period—we will say at the end of 50 years from the completion of the dam—how much, if any, surplus revenue would you have from the power, after paying for the cost of the dam and power plant?

Major BUTLER. I have already stated, under certain conditions, that the dam and power plant will be paid for in 30 years after the beginning of expenditures thereon.

In 40 years, or 10 years longer, the accumulated surpluses from power will amount to $140,000,000 and if interest at 4 per cent is allowed on these surpluses, they will amount to $168,070,000. I have not with me the figures to show what the surplus will amount to at the end of 50 years after completion of the dam.

The CHAIRMAN. The Chair is desirous of making this statement to the committee, as some members of it have requested some information as to the order of the testimony: Representatives Hill and Summers are simply assisting the committee in presenting this entire picture, and it might be well for Mr. Hill to state the order of testimony which they desire.

Mr. HILL. Have you completed your testimony, Major Butler?

Major BUTLER. I have a few more remarks to make.

Mr. MARTIN. Did I understand you to say that the total cost of this installation would be $375,000,000?

Major BUTLER. The cost of the dam and power plant is estimated to be $171,187,000, of which $22,329,000 is interest; the cost of the irrigation works is $221,722,000 of which $40,896,000 is for interest; the total cost of both the power and irrigation development with interest, is close to $393,000,000. I refer you to pages 331 and 752, paragraphs 590 and 1571, part 2, of the report on the Columbia River, also to paragraphs 552–559, inclusive, of Appendix 5 to said report.

Mr. ARENTZ. I think it would be very interesting, Mr. Hill and Mr. Summers, when some of these questions are asked, if you refer to the page of the record where those figures can be found, so that these figures will supplement what the witness may say, and the members of the committee will have it much clearer.

Mr. SUMMERS. That would have to be done when the major is correcting his remarks.

Mr. ARENTZ. Yes, he can say, "Refer to page so and so of the record."

Major BUTLER. I will be very glad to do that. Gentlemen, when you go into the detailed costs, it is very difficult to state them offhand, because we have made so many different set-ups and so many different possible combinations in order to cover every possible situation. However, these matters are treated quite completely in the report.

Mr. MARTIN. What do you get as the total figure?

Major BUTLER. $393,000,000 for the total construction cost of the combined power and irrigation development, including interest charges.

Mr. MARTIN. Well, now, that is very interesting. I asked that to show what a gigantic undertaking this is. Comparing it with the Panama Canal——

Major BUTLER. It is greater, of course, than the Panama Canal. The actual investment necessary by the Government, of course, would not be nearly as large as at Panama and the development would cover perhaps 40 or 50 years, instead of 10 at Panama.

Mr. MARTIN. The Panama Canal, you remember, was built in exactly 10 years. We got started in 1904 and it was finished in 1914, and the cost of the Panama Canal, excluding fortifications, was $375,000,000. So you have here a project as big as the Panama Canal. That is something to show you the great wealth of that country, and it's potential wealth, and the development of the country.

Mr. SUMMERS. The enormous industrial development that has taken place in the last 30 years.

Mr. ARENTZ. While you are on the question of a comparison between the Panama Canal and this project, I think it would be well to place in parallel columns the returns from the tolls through the Panama Canal, and the probable returns from this project from the sale of power.

Mr. MARTIN. That would be very interesting.

Major BUTLER. The returns from this project would likely be in excess——

Mr. MARTIN. I doubt that very much. The Panama Canal has been a great paying institution.

Major BUTLER. Yes, sir; I am a firm believer in the merits of the Panama Canal.

Mr. MARTIN. The Panama canal is paying it's way.

Mr. ARENTZ. It will be very interesting to have it in parallel in order that we may grasp it.

Major BUTLER. Gentlemen, I have a comparison here between some of our costs and the costs figured out by the Bureau of Reclamation.

Mr. MARTIN. I think it would be well to put it in the record.

Mr. HILL. Is that a comparative statement you have?

Major BUTLER. Yes.

Mr. HILL. I wonder if you will submit it for the record?

Major BUTLER. I will be very glad to submit it for the record.

(The comparative statement referred to is here printed in full as follows:)

Comparison of costs, Columbia Basin irrigation project

	Bureau of Reclamation	District engineer, Seattle
Construction cost of high dam and power plant	$168,366,000.00	$148,858,000.00
Interest during construction	17,524,000.00	22,329,000.00
Total cost of power section of project	185,890,000.00	171,187,000.00
Primary pumping plant	8,890,000.00	15,631,300.00
Repumping plants	7,525,000.00	6,049,270.00
Drainage	4,800,000.00	5,997,150.00
Buildings, etc	1,484,000.00	1,201,600.00
Wasteways	2,230,000.00	2,162,710.00
Wells	200,000.00	200,000.00
Telephones	240,000.00	225,000.00
Distribution system, including main canal	176,899,000.00	149,358,300.00
Construction cost of irrigation section	202,268,000.00	180,825,330.00
"Priming," or extra operations and maintenance during construction	5,997,000.00	
Interest during construction		40,896,850.00
Total cost of irrigation section	208,265,000.00	221,722,180.00
Grand total	394,155,000.00	392,909,180.00
Total cost of irrigation section, per acre, without interest on irrigation costs	173.55	150.76
Total cost of irrigation section, per acre, with interest at 4 per cent on irrigation costs		184.86
Estimated sum that surplus power revenues will pay on irrigation costs, per acre, in 40 years	85.00	(1)
Annual cost of power project (operation, maintenance, depreciation, sinking fund, etc.), exclusive of interest	1,733,887.00	2,614,457.00
Annual cost for operation, maintenance, and depreciation of irrigation project, per acre	2.19	2.80
Annual cost of power for pumping, per acre	1.00	1.20
Total annual irrigation costs, exclusive of interest on the reclamation project and amortization	3.19	4.00
Annual interest charges, per acre, on the reclamation project, after completion, if interest is charged		7.39

[1] The above costs apply to plan 4 of the pumping project as set forth in the report of the district engineer (Seattle), Corps of Engineers. Plan 4 is designed to irrigate 1,199,430 acres, taking the entire water supply from the Columbia River at the Grand Coulee Dam site. Plan 4A is the same as plan 4, except that 140,520 acres in the project, known as the Priest Rapids area, would be irrigated by pumping from the Columbia near Bend instead of from the Grand Coulee Dam site. Other combinations were worked out where the capital and annual costs vary, to some extent, from plan 4. These costs should not be confused with those given for plan 4. It is estimated, according to the report of the district engineer, that if no interest is charged on the irrigation project, the surplus power revenues will meet approximately one-half the irrigation costs. While no calculations have been made, it is possible, if reclamation is deferred until Grand Coulee power is about absorbed, that the surplus power revenues would pay about one-half the cost of irrigation, even with interest charged thereon.

Mr. HILL. Mr. Chairman, I would like also to ask Major Butler, if he has a statement prepared on the economic features of the reclamation, if he would submit it for the record also?

Major BUTLER. I have a chart, designated Plate 144 in our report, which shows that the assessible indirect benefits resulting from the development of the Columbia Basin irrigation project will exceed the capital costs of the irrigation part of the project by nearly $33,000,000. This chart was prepared by Mr. Walter Packard, who made the economic studies of the project for us and whom we regard as a very able economist, having had a great deal of successful experience in connection with irrigation projects in California and elsewhere. (The chart, Plate No. 144, was marked "Exhibit 11.")

Mr. HILL. Have you got any statement in typewritten form that you could submit, independent of the chart?

Major BUTLER. You mean about the justification for the project?

Mr. HILL. Yes, sir; the figures you have got on this chart—have you got them written out so that they could go into the record?

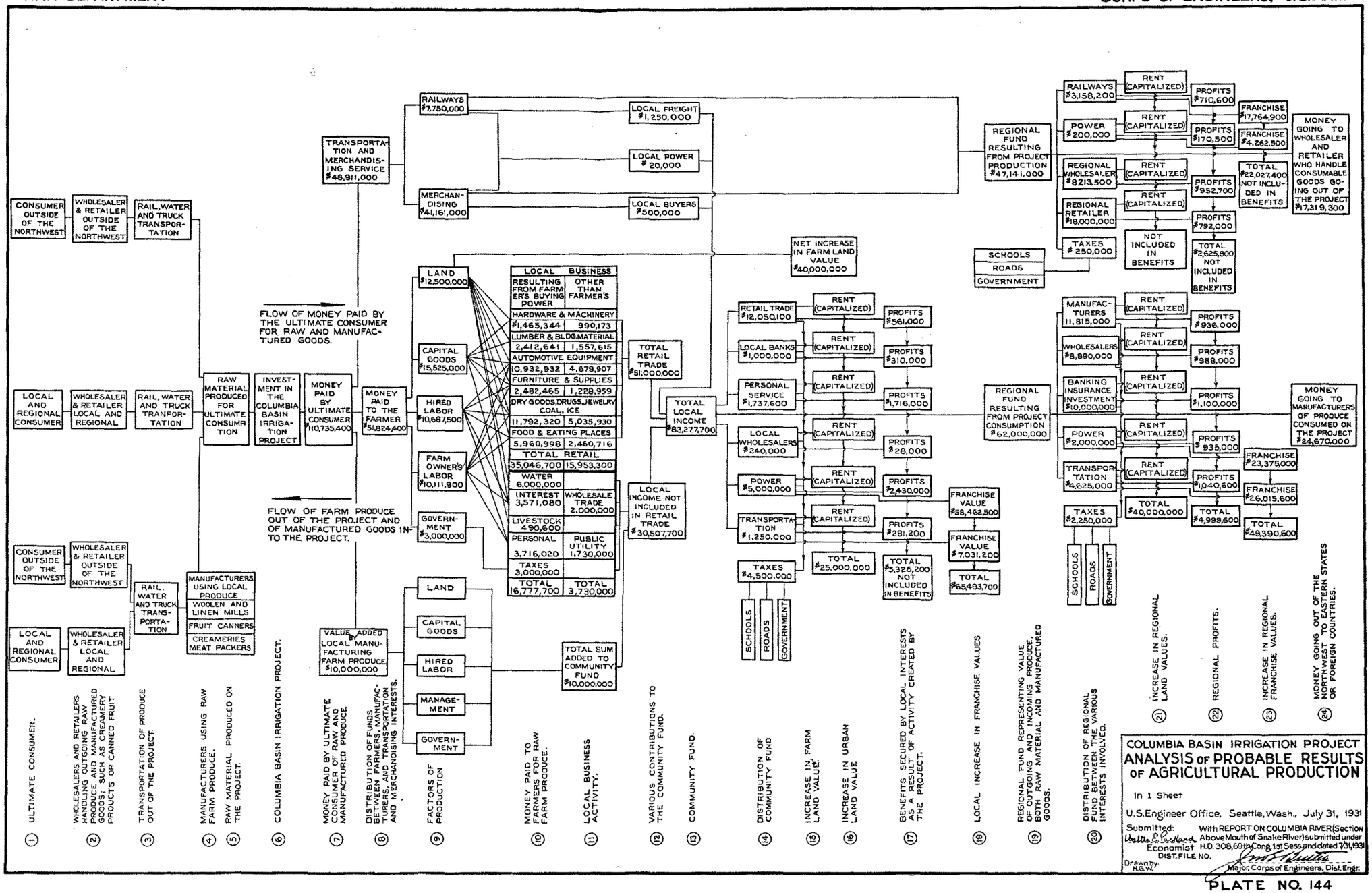

PLATE NO. 144

125965—32. (Face p. 54.)

Major BUTLER. Well, this chart really speaks for itself.

Mr. LEAVITT. It is hard to get that in the record.

Major BUTLER. Gentlemen, the discussion of this chart occupies from page 864 to page 889 and from paragraphs 1852 to 1935, inclusive, of my report. If you desire, I will go into this discussion at length but I have been trying to emphasize the essential features of the project rather than go into too much detail at this time.

Mr. HILL. I will ask Mr. O'Sullivan, in order to save time, to prepare a summary of the discussion in the report and an analysis of the chart for the record.

Mr. MARTIN. The whole of the survey covered by House Document No. 308 includes that. We should have the entire report.

(The analysis of the chart above referred to is here printed in full as follows:)

EXPLANATION OF CHART SHOWN ON PLATE NO. 144, REPORT OF DISTRICT ENGINEER, SEATTLE

(Prepared by James O'Sullivan at the request of Congressman Hill)

The chart shown on Plate 144, report of the district engineer, Seattle, entitled "Analysis of Probable Results of Agricultural Production, Columbia Basin Irrigation Project," appears near page 865 of said report and is explained and discussed in paragraphs 1852 to 1936, inclusive.

The purpose of the analysis was to determine if the benefits derivable from the construction of the reclamation project, even if 4 per cent interest were charged thereon, would be sufficient to justify the investment, and, if sufficient, what part of the benefits could be assessed and taxed to help pay the costs. The purpose was also to determine if there would be justification for the use of the power revenues from the Columbia River-Grand Coulee Dam and power plant to help subsidize the cost of the reclamation.

The conclusion reached in this analysis is that the benefits will greatly exceed the cost of reclamation; that the assessable and taxable benefits alone will exceed the cost of reclamation by $33,000,000 and that there is complete justification for the taxation of the latter benefits and the use of the power revenues to help pay the cost of reclamation. The conclusion is also made that the pumping project is economic.

The analysis clearly demonstrates the remarkable commercial and industrial business that is founded upon agriculture; that agriculture is the sound basis of growth and prosperity; it explains why agriculture, in the past, has paved the way for our wonderful expansion and increase in wealth and it proves that without agricultural expansion we can have little hope for much growth or stabilized business conditions in the future.

This analysis is based upon facts gathered after a very careful study of the flow of benefits resulting from the construction of irrigation projects, including the Yakima in Washington and the Imperial Valley and Modesto in California and from a study of wholesale and retail trade statistics of Yakima and Spokane, Wash.

To understand the chart it is first necessary to look at the space entitled "Investment in the Columbia Basin irrigation project," column 6. As indicated by the arrows near by, the flow of farm produce out of the project and of manufactured goods into the project is from the right to the left side of the chart, while the flow of money paid by the ultimate consumer for raw and manufactured goods produced on the project is traced from the left to the right side of the chart.

To the left of the space in the chart marked "Investment in the Columbia Basin irrigation project" (column 6) is traced the flow of raw material produced on the project on its way to the ultimate consumer. It is shown that all of this production furnishes business to transportation and to wholesale and retail interests, and that some of it furnished business to linen and woolen mills, to creameries, meat packers, fruit canners, etc. (See columns 1 to 6, inclusive). However, the money results of this flow of goods have not been evaluated, except to the extent of the value of the local manufacturing engaged in processing the farm produce, and therefore can be dismissed from consideration.

To the right of the space marked "Investment in the Columbia Basin Irrigation Project" is traced the flow of money paid by the ultimate consumer for the raw and manufactured products of the project. This sum is given at $110,735,400 in column 7. In column 8, this fund is distributed as follows:

Transportation and merchandizing service	$48, 911, 000
Money paid to the farmers	51, 824, 400
To local manufacturers of farm produce	10, 000, 000
Total	110, 735, 400

In column 9 entitled "Factors of production," these three funds are distributed as follows:

Transportation and merchandizing service:	
Railways	$7, 750, 000
Merchandizing service	41, 161, 000
Total	48, 911, 000
Money paid to the farmers:	
Land	12, 500, 000
Capital goods	15, 525, 000
Hired labor	10, 687, 500
Farm owner's labor	10, 111, 900
Taxes	3, 000, 000
Total	51, 824, 400
Value added to local manufacturing of farm produce: Land, capital goods, hired labor, management, government	10, 000, 000

In column 10 marked "Money paid to farmers for raw farm produce" is shown another and more detailed distribution of the farmers' income as follows:

Hardware and machinery	$1, 465, 344
Lumber and building material	2, 412, 641
Automotive equipment	10, 932, 932
Furniture and supplies	2, 482, 465
Dry goods, drugs, jewelry, coal, ice, etc	11, 792, 320
Food and eating places	5, 960, 998
Water (irrigation district)	6, 000, 000
Interest on borrowed money	3, 571, 080
Livestock, work stock and feeders	490, 600
Personal services, amusements, etc	3, 716, 020
Taxes (county)	3, 000, 000
Total	51, 824, 400

In column 11 marked "Local business activity" is shown the extent to which the fund spent by the farmer is augmented by the money spent by the urban population and other local interests which are occupied in supplying goods and services to themselves and to the farmers, as follows:

Hardware and machinery	$990, 173
Lumber and building material	1, 557, 615
Automotive equipment	4, 679, 907
Furniture and supplies	1, 228, 959
Dry goods, drugs, jewelry, coal, ice, etc	5, 035, 930
Food and eating places	2, 460, 716
Total retail trade	15, 953, 300
Wholesale trade	2, 000, 000
Public utility	1, 730, 000
Total	19, 683, 300

In columns 12 and 13, we find a summary of the various contributions to the local community fund, as heretofore shown by the distributions of the farmers' income and the income of other local interests aside from farming, as follows:

Money paid to the farmers	$51, 824, 400
Funds contributed by local interests other than farming	19, 683, 300
Money paid to local manufacturers of farm produce	10, 000, 000
Total	81, 507, 700
Money paid for local freight	1, 250, 000
Money paid for local power	20, 000
Money paid to local buyers of farm produce	500, 000
Total local income (expenditures)	83, 277, 700

Heretofore it has been shown that the money paid by the ultimate consumer is divided between the farmers, those engaged in manufacturing farm produce, and the transportation and merchandizing interests. The last three items in the above table represent the sums left in the local community by the transportation and merchandizing interests, the balance of this fund flowing on to the regional community, and being marked in column 19 as "Regional fund resulting from project production, $47,141,000."

In columns 12 and 13, the summary of the contributions to the local community fund is set up a little different than stated above, the total being the same. It will be noted that the total retail trade, in the local community, is given at $51,000,000, almost equal to the sum paid to the farmer for his produce. The local income, not included in the local retail trade, is given at $30,507,707. These two items, plus the sums spent for local freight, local power, and local buying equal $83,277,700, the total local community fund.

In columns 14–18, inclusive, are respectively shown a further distribution of local community funds, the increase in farm land value, the increase in urban land value, the benefits (profits) secured by local interests (other than farming) as the result of activity created by farming and the local increase in franchise values.

In column 14, we find the total local community fund again distributed as follows:

Retail trade	$12, 050, 100
Local banks	1, 000, 000
Personal service	1, 737, 600
Local wholesalers	240, 000
Power	5, 000, 000
Transportation	1, 250, 000
Taxes	4, 500, 000
Total	25, 777, 700

Some of these items apparently represent distributions made for new business created by the handling of incoming products, especially manufactured articles, consumed on the project. The item for rail transportation apparently refers to incoming freight. The item for power represents expenditures for power consumed on the project. In any event, it will be noticed that the total local income (column 13) less the above items, except taxes, equals the total income that flows to the regional community and equals the regional fund resulting from project consumption or $62,000,000 as shown in column 19.

In column 15, we find the net increase in farm-land value to be $40,000,000. This value has been arrived at in the discussion accompanying the chart.

In column 16, we find the increase in urban-land value to be $25,000,000. This apparently has been worked out by capitalizing the profits shown in column 17.

In column 17, we find that the local profits of other business created by the irrigation activity are $5,326,200.

In column 18 the local increase in franchise values is given at $65,493,700, as follows:

Power company franchises	$58, 462, 500
Railway franchises	7, 031, 200
Total	65, 493, 700

The above increases have been worked out in the discussion accompanying the chart.

Up to this point, we have considered only the benefits from the construction of the project that will occur in the local (project) community. In column 19 entitled "Regional Fund Representing Value of Outgoing and Incoming Produce, Both Raw Material and Manufactured Goods," we find the following funds reaching the regional (Northwest) community as a result of the development of the project:

Regional fund resulting from project production	$47, 141, 000
Regional fund resulting from project consumption	62, 000, 000

In column 20, we find the distribution of the regional fund among the various interests involved. In column 21 we find the profits of these enterprises, as shown in column 22, capitalized in terms of increased regional land values and in column 23 we find the increases in regional franchise values.

Of the regional fund resulting from project production, viz, $47,141,000 we find the following distribution among regional interests:

Railways	$3, 158, 200
Power	200, 000
Regional wholesaler	8, 213, 500
Regional retailer	18, 000, 000
Taxes	250, 000
Total	29, 821, 700

If we deduct this sum from the regional fund resulting from project production, we arrive at the amount of money going out of the Northwest to Eastern States or foreign countries or in other words to the wholesaler and retailer who handle consumable goods going out of the project. This sum amounts to $17,319,300 as shown in column 24.

The profits made by the above interests amount to $2,625,800 and the increased values of the franchises of the above railway and power interests amounts to $22,027,400 but neither is included in the estimated benefits resulting from the project.

Of the regional fund resulting from project consumption, viz, $62,000,000, we find the following distribution among the various regional interests:

Manufacturers	$11, 815, 000
Wholesalers	8, 890, 000
Banking, insurance, investment	10, 000, 000
Power	2, 000, 000
Transportation	4, 625, 000
Taxes	2, 250, 000
Total	39, 580, 000

If we deduct this sum from the regional fund resulting from project consumption, less the item for taxes, we arrive at the sum going out of the Northwest to Eastern States or foreign countries or the sum going to manufacturers of produce consumed on the project as stated in column 24, viz, $24,670,000.

The regional profits resulting from the above enterprises amount to $4,999,600. The increases in the valuations of the franchises in the regional community are as follows:

Power companies	$23, 375, 000
Railways	26, 015, 600
Total	49, 390, 600

The total increase in regional land values resulting from all of the above regional activity resulting from the project amounts to $40,000,000.

In column 24 it is shown, as has already been pointed out, that the money going to Eastern States or to foreign countries will be as follows:

Money going to wholesaler and retailer who handle consumable goods going out of the project	$17, 319, 300
Money going to manufacturers of produce consumed on the project	24, 670, 000
Total	41, 989, 300

Of the many interests that will be benefited, directly and indirectly, by the construction of the project, the analysis concludes that the following interests could and should be assessed and taxed to help pay for the project, stating that the contribution of urban towns and cities alone should be $25,000,000:

Farm land increase in value	$37, 600, 000
Local (urban) increase in land value	25, 000, 000
Regional (northwest) increase in land value	40, 000, 000
Railway franchise increase in values	33, 046, 800
Electric utility franchise increase in values	81, 837, 500
Total	217, 484, 300

PUMPING PROJECT ECONOMICALLY FEASIBLE

The report of the district engineer shows (Pl. 142) that the revenues from power, plus the revenues from the settlers, under the conditions set forth as to the price of power, the rate of land settlement, etc., will pay for the entire project including both the power development and the reclamation with interest at 4 per cent in from 60 to 78 years. If the power is sold for 2 mills per kilowatt-hour, net, and the rate of land settlement is 25,000 acres per year, the project will be paid for, with interest at 4 per cent on the power and reclamation costs, in 78 years. If sold for 2.2 mills, net, under the same conditions, the entire project will be paid for in 60 years.

In addition to the foregoing direct returns, the construction of the project not only makes possible a vast amount of valuable business locally, regionally, and nationally, but also creates assessable values that exceed the cost of reclamation, with interest, by $33,000,000. These assessable values alone amount to $217. per acre, while the per acre cost of the project, including interest, is $184, or $33 an acre less than the amount of the benefit, per acre. The analysis concludes, therefore, that the project is more than justified, economically, that the assessable interests benefited should be taxed to help pay the costs and to shorten the period of repayment, and that there is complete justification for the using of power revenues to subsidize this reclamation.

Mr. OVERTON. What is the average distance the electrical energy will have to be transmitted before it is used?

Major BUTLER. I would say less shan 200 miles. It is about 165 miles, in an air line, from the Grand Coulee Dam site to Seattle, which is the center of the Puget Sound region, the largest prospective market for the power. Of course, Spokane is a much closer market, and northern Idaho is about the same distance as Seattle. It is probably 200 miles to Portland.

Mr. MARTIN. Two hundred and twelve miles. Most of this power would have to be used across the Cascade Mountains, in western Oregon and western Washington.

Major BUTLER. Yes, sir; except Spokane.

Mr. MARTIN. It is 90 miles to Spokane.

Major BUTLER. Yes.

Mr. OVERTON. How far can it be transmitted, from an economic standpoint, so that it can be utilized in competition with local interests?

Major BUTLER. Plate No. 124 of our report shows, for example, that power can be transmitted 250 miles, with a load factor of 65 per cent, figuring 6 per cent money on the cost of the transmission lines, for a fraction over 1 mill per kilowatt-hour. Assuming that Grand Coulee power sold for 2.3 mills per kilowatt-hour at the switch, the total cost to the purchaser, delivered 250 miles, would be about 3.3 mills. Plate 60 shows that the cost of steam power would, with the same load factor, be more than 4 mills. In our studies we figured on the possibility of carrying the power as far as 300 miles. We have made our calculations to that extent, but for a big system like this, I do not think it would be necessary to transmit it that far;

because you would have a power network extending over the country and you would feed into that system at the nearest points.

Mr. OVERTON. You stated the total production would be consumed in the course of 15 years; is that dependent on future developments?

Major BUTLER. Our calculations were based upon the expected normal growth in the power market based upon the growth in the past as a guide. We took into consideration expected growth in population, expected increases in the uses of electricity per capita, and other factors, as indicated by past trends. We found that the rate of growth in that area had been 9.5 per cent, compounded, annually, since 1905 up to 1930. To be conservative, we estimated that this rate would gradually decline to 4.75 per cent by 1960 and zero by 1990. Even so, we found that if but one-half of the estimated increased demand for power in that area was served by the Columbia River-Grand Coulee development, this power could be absorbed in 15 years after completion of the dam and power plant.

Mr. LEAVITT. The question I have in mind, Major, is how much of a market for the added power is connected with the development of the reclamation area itself; has that been considered? In developing the irrigation area, are you going to create considerably more demand for power?

Major BUTLER. Yes, of course, that has been given consideration. The amount that will be used on the project lands themselves will be rather small as compared to the total power that will be available. However, it may be expected that the increased population in Washington, Oregon, and Idaho, stimulated by this development, will be considerable. Our estimates show an increase of about 50 per cent in the population of these States by 1960. Am I right about the amount of power that will be used on the project lands, Mr. McClellan?

Mr. MCCLELLAN. Yes, sir; I think so.

Mr. LEAVITT. The question of national defense in connection with the Panama Canal was raised; and it has always struck me, in connection with this project, that it has, from a national defense standpoint, a tremendous value. The orderly development of our population and resources on the west coast is of extreme importance; and the way to develop is through the development of those irrigated sections that become the center of all industry and livestock raising and so on. We have here, of course, a combination of power development and the development of a great area for tremendously aiding the growth of population on the coast. We will never be fully developed, from a national defense standpoint, until the west coast is as fully developed as the east coast. I think that is correct.

Mr. MARTIN. Yes, sir; this would encourage the development of the electric-furnace industry and the manufacture of minerals and so forth.

Mr. LEAVITT. In minerals, we have all of the raw materials necessary for a tremendous development.

Major BUTLER. I was asked by someone here, on the first day of the hearing, what was the total potentional power of the Columbia River. In their report, the Corps of Engineers considered very carefully the power possibilities at certain definite sites on the river in the United States as indicated on the profiles. Under the comprehensive plan of the Corps of Engineers for the development of this

river, as finally recommended by the Chief of Engineers, the total installed capacity at the various power plants on the river would be about 8,000,000 kilowatts or about 10,700,000 horsepower.

It is estimated that the Columbia River alone will produce, in kilowatt-hours per year, close to one-third the total electric power that was produced in the United States in 1930.

A member of this committee has asked me to restate the per acre cost of the irrigation project. I think that will be discussed by the Bureau of Reclamation. However, the costs of placing the water on the land by the pumping plan may be summarized as follows:

PLAN 4.—*1,199,430 acres—the entire water supply from the Columbia at head of Grand Coulee*

Capital cost, plus 4 per cent interest	$221, 722, 180
Capital cost, plus 4 per cent interest, per acre	184. 86
Capital cost, without interest	180, 825, 330
Capital cost, without interest, per acre	150. 76
Total interest on project	40, 896, 850
Total interest on project, per acre	34. 10
Annual interest charges on construction costs after completion	7. 39
Annual cost of operation and maintenance	1. 52
Annual cost of depreciation	1. 28
Annual cost of power for pumping	1. 20
Total annual cost of operation, maintenance, and depreciation	4. 00

For the above data see paragraph 1571, page 752 of the report on the upper Columbia.

Now, gentlemen, I have finally arrived at my conclusions. As previously stated, the purpose of the report of the Corps of Engineers is to produce a comprehensive plan for the use of the waters of the Columbia River, a plan which may be used as a guide for all future construction on the river.

Navigation on the upper Columbia is not important at this time, and probably never will be of great importance. Improvement for navigation, if it is justified, will be in conjunction with the power development; that is, the dams for power will be utilized for navigation purposes, just as is the plan proposed on the lower river. The upper Columbia has wonderful potential possibilities for the development of large blocks of cheap power. However, before appropriations for construction are made by the Federal Government, it should be definitely determined that there is, or will be, a market for the energy, because, otherwise, the carrying charges will be so great as to prohibit cheap rates for power. This can best be done by securing contracts with the power users, in advance, to insure the success of the project.

The investigation shows the very important results that can follow the proper regulation of storage, and indicates the desirability of coordination in the control of the storage, if the greatest benefits are to be obtained.

A combination power and irrigation plan should be followed. This involves the construction of a high dam and a power plant in the Columbia River at the head of Grand Coulee, a pumping plant for raising the water from the storage created by the above dam in the Columbia River to the Grand Coulee Reservoir, and the distribution of the water from the Grand Coulee Reservoir by gravity over the

irrigation project. This area should not be settled at too rapid a rate, nor should the irrigation part of the project be started until the power development is well under way. It should also be determined, before the work on the irrigation section is started, that the production from this new area may be absorbed into the markets of the country without causing damage to existing interests. However, a careful survey indicates that the increased population of Oregon, Washington, and Idaho by 1960 will be sufficient to absorb the agricultural production from this project, especially if the project should in the meantime be undertaken.

Our report shows that the longer reclamation is deferred the lower the cost to the settler will be; and, vice versa, the sooner the dam and power plant are completed and the power absorbed, the better will be the guarantee that the cost to the settler will be low, providing that reclamation is deferred.

The problems to be solved in connection with the development of a comprehensive plan of improvement of the Columbia River are of such magnitude and of such importance, and so far reaching in their influence, that no interest, except the Federal Government, can arrive at a satisfactory solution. These problems are not only national in scope, but they have international aspects, on account of the interests of Canada.

President Hoover, when Secretary of Commerce, made an address in Seattle, Wash., on the "National policy in development of national resources," and is quoted as saying:

> We have need that we formulate a new and broad national program for the full utilization of our streams, our rivers, and our lakes. We must no longer think in terms of a single power site, or single storage plant, or single land project, or single navigation improvement. We must think, and thanks to the scientists and engineering, we can think in terms of the coordinated, long-view development of each river system to its maximum utilization.
>
> It is, therefore, hoped that the comprehensive survey now in progress throughout the country, or rencently completed, will provide a sound basis for the adoption by the Congress of a national policy leading to the fullest possible development and utilization of the water resources of the Nation.

I thank you, gentlemen.

Mr. HILL. Now, Mr. Chairman, I want to ask Colonel Cooper to go on for a few minutes, since he has to leave the city, and I want to ask if the committee will be willing to meet to-morrow and continue the hearing to-morrow. I understand Congress will not be in session to-morrow.

The CHAIRMAN. That is my understanding.

Mr. HILL. Will that be agreeable to the committee?

The CHAIRMAN. It will be agreeable to the chairman, and the chairman would prefer to continue the hearing, provided there is no objection on the part of the committee. If we hear no objection, we will be glad to continue the hearing to-morrow morning.

Mr. HILL. We want to thank Major Butler.

The CHAIRMAN. Major, I would like to ask this question as to the approximate charge per acre for reclamation on this project; how does it compare with other reclamation charges at present?

Major BUTLER. Gentlemen, that is a question that I feel sure that the Bureau of Reclamation can answer better than I can.

Mr. HILL. They have gone into that very completely. Colonel Cooper, will you favor us with a statement on this project? I will

state that Colonel Cooper has had a great deal of experience in investigating the power standpoint and also the reclamation standpoint of the Columbia River. It is not necessary for me to introduce him since everybody knows him.

STATEMENT OF HUGH L. COOPER, ENGINEER, NEW YORK CITY

Colonel COOPER. Mr. Chairman and gentlemen, I am not here prepared to make any extended statement, or any detailed statement, except to say that I have studied the power potentialities of the Columbia River since 1920, now 12 years ago. I was instrumental in getting the State of Washington to appropriate $50,000 to explore the bedrock situation at the site of this proposed dam. The reason that we initiated the exploration was because the geologists told us that the bottoms were down about 300 feet or 400 feet, which is a little more than any modern engineer wants to tackle.

Following the disclosure that the bottoms under that proposed plan were at a satisfactory level, then came the question of whether or not the irrigated land, the land that should be irrigated, should be supplied with water from a gravity plant or from a pumping plant. As the result of a rather spirited contest between these two proposals, a great deal of loose talk took place, followed by a lot of very sound talk.

I think that the work that the War Department has done in the question of investigating the potentialities and value of this power to the State and Nation is a splendid piece of work. I think that the thoroughness with which they have entered into the investigation justifies sound confidence on the part of this committee and Members of Congress. Of course, the details of it, as Major Butler has stated, have yet to be worked out; but enough information has been brought to the surface to show, first, that the power potentialities of the Columbia River are greater than are to be found on any other river on the North American Continent; and that the cost of the power will be so low as not to be disturbed in that position by anything that science can produce in the future.

When we are able to prove that the cost of the power on the Columbia River, which can be produced absolutely from water power, is less than one-half the cost from steam, or gas, or Diesel engines, or anything else, even though the materials cost nothing, you have a basis of repose in which you do not have to be bothered with the sliding rule or bare technicalities or anything about relativity.

The cost is extraordinarily low; it is lower than you can get at Niagara Falls, the greatest natural water power on the North American Continent, which can not compete with the water power in the Columbia River.

It seems to me it would be a very great mistake for Congress to authorize any works on the Columbia River that were not entirely comprehensive; that is to say, that does not take into account all of the potential power developments and their value to irrigation, and their value in building up of new industries, their value in the matter of developing the natural resources, outside of irrigation, which are very considerable. So that I personally think that this report, which is comprehensive—that is the value of it, the practical value of it, to my mind—that it is a comprehensive report, in which the total values are evaluated; and I think that the country is to be congratulated, first, because the War Department has made so exhaustive a study; and,

second, that the Reclamation Service find themselves so nearly in accord with what the War Department has worked out. It does not always happen that engineers get in agreement as well as that. As a class, we are supposed to be governed principally by the idea that we must never agree with anything or anybody. That is not true, but we are tarred with that stick, and it is a great help to me as a citizen and as a taxpayer of this country to know that these two great departments are in harmony on this whole development.

Now, I do not think I ought to take any more of your time, but if you have any questions that I can answer, I will be glad to do it; but I do not want to take any more of your time, gentlemen.

Mr. HILL. Colonel Cooper, I wish, for the record, you would state some of the principal dams and large construction works that you have constructed or have had in charge.

Colonel COOPER. I am responsible for about 2,000,000 horsepower in different parts of the world that are now under operation, and that includes the plant at Niagara Falls, about 185,000 horsepower; at Keokuk, Iowa, across the Mississippi River, 190,000 horsepower; Muscle Shoals, 670,000 horsepower; McFalls Ferry, Pa., 300,000 horsepower; and a whole lot of small things, including 900,000 horsepower across the Dneiper River in Russia, which is just now being finished; but I do not think that means that I know anything about it.

The CHAIRMAN. Colonel, you stated that you do not think that it is a wise policy for the Government to use the potentialities of the Columbia River except on a large scale, or in a large proportion; what is your judgment about this particular site at Grand Coulee? I am sure that you are informed as to that country, generally. What would be your judgment as to that matter?

Colonel COOPER. Well, I think that the development at Grand Coulee should be undertaken just as soon as the work there that is still to be done is completed, and the economic situation we find ourselves in at that time dictates.

I want to correct one thing in your mind, Judge, and that is this: That I said that the Government should not permit any undertaking of this Columbia River situation until there had been full values determined and that they should be installed in their natural sequence. That is what I meant to say. I do not think I said it, but I am glad you brought that point up.

Mr. MARTIN. In other words, you would have a study made of the different sites proposed, and settle on one and develop it gradually?

Colonel COOPER. Yes, you can not put a million horsepower into this market just by dumping it; you would have to go through a very severe economic growth; you have got to begin with the acorn, before you get your oak tree; and the same thing is true with the water power business, or any other business.

Mr. MARTIN. You made a very interesting statement, one that surprises me, in view of what certain people have told me: That electric power can be developed at one-half the cost of steam-generated power.

Colonel COOPER. Under this plan.

Mr. MARTIN. With the fuel costing nothing?

Colonel COOPER. Yes, under this plan, with the fuel costing nothing; and I want to be very definite about that, that the fuel must cost nothing.

Mr. MARTIN. I wish you would repeat that statement, because I will be likely to use it.

Colonel COOPER. I will be very glad to have you use it.

Mr. MARTIN. I wish you would repeat it, please.

Colonel COOPER. My statement is that, under the Columbia Dam head you are talking about, you can produce power at 1.2 mills per kilowatt-hour; and that if the steam fellows tried to produce it at 2.4 mills, which is double your price, they could not do it, even if they got their fuel for nothing.

Mr. MARTIN. That is the point.

Colonel COOPER. I am very glad to make that statement, for I have been in this business for 40 years; and I have been hearing steam fellows tell how we were going to be thrown out the window, for 39 years and 11 months.

Mr. MARTIN. It is a fact, is it not, Colonel, that steam-generated power has been going down in cost?

Colonel COOPER. Yes, that is very true; and we have got the boiler pressure up to about 1,200 pounds per square inch, and we have got every refinement that can be safely tried; and there is not a plant in the United States, where all of its charges are met and taken care of, that is furnishing power on the switchboard for less than 4 mills per kilowatt-hour; and I want that put in the record.

Now, the reason I say that so carefully and so precisely is that I have been making it my business to review the cost, every two years, on something like 15 of the biggest generating stations on the North American Continent. My relations with these people who run these stations are such that I have access to their actual costs; and it is based upon that kind of knowledge that I tell you what I have told you just now.

Mr. ARENTZ. Is it not true, Colonel, that in other places the amount of fuel used for generating a kilowatt-hour—the more you reduce that cost, the more your original investment and machinery goes up?

Colonel COOPER. Yes; that is true.

Mr. ARENTZ. And you can not, in any way, decrease that first primary investment in machinery, which deteriorates so very fast; the life of that machinery is of short duration?

Colonel COOPER. Yes.

Mr. ARENTZ. Yet the life of the machinery installation in a hydropower plant is great, because the parts to be replaced are of insignificant value, compared to the cost of the total installation?

Colonel COOPER. You have evidently been in the power business, or else studied it intelligently, I do not know which. I went over to the Keokuk plant that we built 20 years ago on the Mississippi, the other day, and I asked the superintendent what was the first thing he had to replace, and he said he would not know until about another 15 or 20 years.

Mr. ARENTZ. On the Columbia River, you have no silt in your water; the water is practically clean?

Colonel COOPER. Yes, and you have no ice.

Mr. ARENTZ. And the repairs on the moving parts are very small?

Colonel COOPER. Yes. I would like to say, Mr. Chairman, that I came down here not of my own volition, at all. If you look over your notes, you will see I am around Congress and Washington very little, and the only reason I am down here to-day is because Mr. O'Sullivan

thought it would be nice if I came. If I can be of any use to you, of course, I am glad to do it, but I did not come here voluntarily.

Has anybody else any questions?

Mr. O'SULLIVAN. What is your opinion about the feasibility of building this large dam?

Colonel COOPER. I think it is absolutely safe from every standpoint. There is no way that any experiments will have to be undertaken. It is sound, and there is nothing about it that is unsound; it has even got a good, granite foundation, thank God.

Mr. SUMMERS. Following the very illuminating statement by Mr. Arentz and your comments, what might be said, in a general way, of the permanence or the durability of this proposed construction?

Colonel COOPER. Well, I think the machinery that goes into it could be depended upon, without replacement, for about 30 years, and the balance of it for 150 years, if they do the work as well as they know how to do it, which I am sure they will do.

Mr. SUMMERS. The part that might have to be replaced within 30 years would be what?

Colonel COOPER. That is only about 5 or 6 per cent of the total cost.'

Mr. SUMMERS. That is what I wanted to know.

Colonel COOPER. Yes; 5 per cent or 6 per cent of the total cost. That is the most valuable asset that the Nation has got, and it is a marvelous asset the State of Washington has; and it is splendid to know that you are not going to mutilate it by cutting it up to suit a lot of miscellaneous ideas of a lot of nincompoops. I think they have got a fine proposition, a comprehensive proposition, and all you have got to do is proceed forth in the future with respect to it with the same intelligence you have shown in the past, and it will be a great blessing to this country when you do it.

Mr. CROSS. Just a question. I am not familiar with dam building. Do you know whether or not there has been sufficient testing there to find out whether there are any seams in the rock after you hit it?

Colonel COOPER. I would take a chance now. I have just built a dam that is in a damn site harder place to build than this, in Russia, and we took a lot of chance on the seams, and we did not have anything like as good information as the Government has already got here, and we have been successful through all of it, and the dam has been under test, and it is all right now. However, from what Major Butler told you, they ought to go back and do some more drilling, not to see whether the dam can be built at all or not, but to find out what special treatment should be given to it in the matter of detail, not upon the question of whether it should be undertaken, or not. I think they have got all of the data they need for that purpose; I am very sure they have.

Mr. O'SULLIVAN. In putting in the test holes, the drillers went from 50 to 75 feet into solid bedrock.

Mr. SUMMERS. Colonel, we look on this as a great national asset; would you discuss it, just a moment, from that angle?

Colonel COOPER. Well, I agree with you that it is a great national asset, and I think the magnitude of that asset is very difficult to put in words. This particular project you are here discussing will throw into use, some day, about 8,000,000,000 kilowatt-hours, per annum,

and that is about 6½ per cent of our total national consumption of kilowatt-hours of all kinds, steam and water combined.

Mr. SUMMERS. At the present time?

Colonel COOPER. Yes.

Mr. MARTIN. Are you speaking of the Columbia River as a whole?

Colonel COOPER. Just this one project.

Mr. MARTIN. Just this one project?

Colonel COOPER. Yes; of course, there is a lot of other projects there that will add to the aggregate in addition to that I am talking about. I am just talking about this one project; and it will produce around 8,000,000,000 kilowatt-hours per annum—6½ per cent of our total national production. Unless this world is about to come to an end, which I do not think it is, we are going to continue, more and more, to need hydroelectric energy, or energy in some form.

In that particular part of the United States, there is a vast number of various natural resources, principally metallurgical, and they will require particular treatment from electric power. At the time when the world needs the resources of the State of Washington, they will come into the picture with great force, because they can be handled with this cheap power.

I think that is so, gentlemen, in spite of the fact that I have labored under a disappointment with respect to the State of Washington for about 16 years; but I believe the time will come when the State of Washington, because of its water power, because of its materials, and because of other things that may be spoken of, will be one of the richest States in all of the Union, and nothing can stop it. That is based upon common sense and the comprehensive plus and minus discussion of natural resources.

I would like to repeat that it is a great pleasure to me to see that anything so absolutely valuable is not to be mutilated. I have heard the same kind of talk about Niagara and the St. Lawrence and the Great Lakes situation, and talked with different people in the different parts of this country, including the present President, and you can not say that, with respect to the St. Lawrence; but you can say with respect to this project, that this project on the Columbia is not being mutilated, and the St. Lawrence is likely to be mutilated. There is just that difference; and for an engineer to see a perfectly valuable opportunity mutilated by ignorance, and so forth, it is pretty painful.

That is all I have got to say.

The CHAIRMAN. Very well, the committee will stand adjourned until 10 o'clock to-morrow morning.

(Whereupon, at 12 o'clock noon, the committee adjourned to meet at 10 o'clock a. m., Saturday, May 28, 1932.)

APPENDIX

REPORT OF THE CHIEF ENGINEER OF THE RECLAMATION SERVICE TO THE COMMISSIONER OF RECLAMATION, DEPARTMENT OF THE INTERIOR, DATED JANUARY, 7, 1932

LETTER OF TRANSMITTAL

DEPARTMENT OF THE INTERIOR,
BUREAU OF RECLAMATION,
Customhouse, Denver, Colo., January 7, 1932.

From: Chief Engineer.
To: Commissioner, Washington, D. C.
Subject: Report on proposed Columbia Basin project, Washington.

1. Transmitted herewith is a report prepared in the Denver office on the proposed Columbia Basin project.

2. The report shows that the investment in the dam and power plant will be repaid under the conditions assumed in 50 years with interest at 4 per cent and leave a substantial surplus for repaying about one half of the investment without interest ultimately required in the entire irrigation development. With this surplus power revenue available for liquidating a portion of the investment in the irrigation development, and on the basis of the estimates and conclusions reached in the report, I believe the Columbia Basin project is physically and financially feasible. With the completion of the power development the irrigation development may proceed at such time and in units of such size as economic conditions may justify.

3. The postponement of the irrigation development will increase, rather than detract, from the economic feasibility of the power development except as such irrigation development affects the power market.

R. F. WALTER.

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ACKNOWLEDGMENT

Prior to the preparation of the following report there was made available to the United States Bureau of Reclamation a very comprehensive report and a large amount of supporting data prepared under the immediate direction of Maj. John S. Butler, Corps of Engineers of the United States Army. The investigations by the Corps of Engineers was authorized by the Congress of the United States under section 1 of the river and harbor act of January 21, 1927, and in accordance with House Document No. 308, Sixty-ninth Congress, first session.

Full use has been made of the reliable and up-to-date information contained in Major Butler's report. The maps, plans, and calculations contained therein have been of much value and their availability has saved the expense of surveys and studies which otherwise would have been necessary for the preparation of this report.

Among the other available reports utilized in the preparation of this report, special mention should be made of the comprehensive investigations conducted by the State of Washington and the earlier studies of the Bureau of Reclamation.

THE COLUMBIA BASIN PROJECT

SUMMARY

The Columbia Basin project as considered in this report involves the construction of the following principal features:

(*a*) The Columbia River Dam, about 450 feet in height above the foundation, which, with appurtenant structures, will contain about 11,266,000 cubic yards of concrete and create a reservoir about 150 miles long, extending to the international boundary, the water surface of which will be about 355 feet above the low-water surface of the Columbia River.

(*b*) The Columbia River power plant containing an installation of turbines and generators of 2,100,000 horsepower capacity.

(*c*) The Columbia River pumping plant, containing an installation of motor-driven pumps of 16,000 cubic feet per second total capacity.

(*d*) A dam at each end of the Grand Coulee to form the Grand Coulee Reservoir about 23 miles long.

(*e*) Pipe lines leading from the Columbia River pumping plant to a supply canal 1.7 miles long which, in turn, leads to the north end of the proposed Grand Coulee Reservoir.

(*f*) An irrigation distribution system consisting of canals, tunnels, siphons, wasteways, bridges, head gates, etc., distributed over the main canal extending from the south end of the proposed Grand Coulee Reservoir, a distance of about 11 miles, from which point it branches into the main west canal and the main east canal. Each of these branch canals supply smaller canals equipped with suitable structures, the final reduction being to the size necessary to supply each 160-acre farm.

(*g*) Power plants and transmission lines at suitable places along the canals of the distribution system for the generation and distribution of about 26,000 kilowatts of seasonal power.

(*h*) Motor-driven pumping plants at suitable places along the canals to repump water a maximum of 100 feet to the various areas adjacent thereto.

(*i*) A drainage system to carry off seepage waters developed with the irrigation of land.

(*j*) Telephones and buildings necessary for the operation of the project and wells for water supply during the construction period.

As a result of the construction of the foregoing items the following uses of power and water are proposed:

(*a*) The production at the power plant at the Columbia River Power Dam of 800,000 kilowatts of firm continuous power which will be available for commercial sale.

(*b*) The use of the secondary power generated at the Columbia River Dam to pump water from the Columbia River Reservoir to the

Grand Coulee Reservoir, the maximum difference of elevation between the surfaces of the two reservoirs being about 365 feet.

(*c*) The use of the water pumped into the Grand Coulee Reservoir to furnish an irrigation supply to 1,200,000 acres of land.

(*d*) The seasonal power generated at power plants at various drops on the project canals to be transmitted to pumping plants along the canals to lift water a maximum of 100 feet for irrigating 219,000 acres of the above-mentioned 1,200,000 acres.

The territory considered as the market area for the Columbia River power includes the area within a radius of 300 miles of the dam site embracing all of the State of Washington, the northern part of Oregon, the northern part of Idaho, and the western part of Montana. The present installed capacity of municipal and utility plants within this territory totals about 1,000,000 kilowatts, of which about 28 per cent is steam-electric power.

During 1920 to 1930 power requirements in this territory increased at an average rate of 9.5 per cent per year, compounded annually. For this report, a gradually decreasing rate of increase has been assumed beginning with 8 per cent in 1930 and decreasing to 4 per cent in 1960. Practically all of the power of the major hydroelectric developments on which construction has been started by the various power companies and municipalities will have been absorbed by 1940, which is the earliest date that power from the Columbia River development could be made available. The additional generating capacity required during the 15-year period 1940 to 1955 would amount to about 3,000,000 kilowatts whereas the proposed installation at the Columbia River Dam is 1,500,000 kilowatts or only one-half of the expected increase. With proper cooperation on the part of the various power companies and municipalities the proposed Columbia River development should be absorbed in this 15-year period.

Comparative estimates indicate that a price of 2.25 mills per kilowatt-hour should be sufficiently attractive to induce the power companies and municipalities to purchase energy in lieu of constructing additional power plants and to insure that the Columbia River power will be absorbed as rapidly as the growth of load will permit. Based on the absorption of 800,000 kilowatt of continuous power in 15 years, a price of 2.25 mills per kilowatt-hour for firm power, a price of $1 per acre per year for secondary power used for irrigation pumping, which is equivalent to approximately .5 mill per kilowatt-hour and land settlement at the rate of 20,000 acres per year, the revenue from power would be sufficient to repay the cost of the Columbia River Dam and power plant with interest at 4 per cent per annum in 50 years, in addition to providing for the operation, maintenance, and depreciation of the dam and power plant, and also provide a surplus of approximately $144,000,000 which would be available for repayment of the cost of the irrigation development and other purposes.

With the estimated surplus power earnings available for liquidating a portion of the irrigation investment, the annual construction charges to be paid by the land beginning four years after settlement and continuing for four years at a rate of $2 per acre and thereafter at $2.50 per acre for 32 years, will repay half of the cost of the investment in the irrigation project within 40 years from the time that water is available for each unit or division.

Investment in project

Columbia River Dam	$125,750,000
Columbia River power plant	42,616,000
Subtotal	168,366,000
Interest during construction on above	17,524,000
Subtotal	185,890,000
Irrigation development without interest (1,200,000 acres)	208,265,000
Total investment	394,155,000

The maximum estimated investment in the combined power and irrigation project up to the time when power revenues are sufficient to reduce the investment is $260,000,000.

CONCLUSIONS

1. The market for power in the territory tributary to the proposed Columbia River dam is sufficient to absorb the total firm power output to be generated at the Columbia River dam within 15 years after the dam is completed.

2. The time required to absorb the power output is a very important factor in the financial success of the proposed development. The power companies and municipalities operating power systems in the territory will have to cooperate to the fullest extent in the utilization of Columbia River power in order that it may absorbed as rapidly as possible.

3. The revenue which will be derived from the sale of commercial power at 2.25 mills per kilowatt-hour combined with the revenue from the sale of power for irrigation pumping at $1 per acre per annum will be sufficient to return within a period of 50 years the investment in the dam and power plant with interest at 4 per cent, to pay the cost of operation and maintenance of the dam and power plant, and leave a substantial surplus for repayment of a portion of the investment in the irrigation development.

4. The surplus from power revenues is estimated to be sufficient to repay within 40 years about 50 per cent of the cost of the irrigation development for the entire acreage of 1,200,000 acres proposed for the project or an average of over $85 per acre. The balance of the irrigation investment must be repaid by the lands or from other sources.

5. Assuming the above surplus power revenues to be available, the total annual charge accruing against the land, beginning four years after settlement, would have to be $4.59 per acre, of which $2 per acre will be available for repayment of the investment in irrigation works. Beginning with the eighth year after settlment to the end of the fortieth year the annual charge must be increased to $5.09 per acre, of which $2.59 per acre will be available for repayment of the irrigation investment, without interest.

6. In order to reduce the annual charges for the irrigation benefits accruing against the land, it will be necessary that the State of Washington, municipalities, and all interests benefited within the irrigation district contribute toward the cost in proportion to such benefits.

7. Ultimate irrigation development is proposed for 1,200,000 acres. The slower the irrigation development proceeds the smaller the amount of additional funds that will have to be advanced from the Treasury of the United States.

8. In order to perfect final construction plans it will be necessary that further information be secured by diamond drilling of the foundation of the Columbia River dam; that additional field exploration and laboratory tests be made to determine the amount and source of supply of the concrete aggregates for the Columbia River dam; that a topographic survey and land classification be made of the irrigable area of the project; that test pits and borings be made to determine the classification of material to be excavated in the main canals of the project distribution system for use in final designs and estimates; and that a survey be made to determine the cost of irrigating land by pumping water from the Spokane River and using Columbia River dam power.

9. No construction on the Columbia River dam and power plant should be undertaken until contracts are executed for the sale of power which will insure sufficient revenue for annual expenses and the repayment of the investment in the dam and power plant with interest at 4 per cent within 50 years.

10. No construction on the irrigation development should be undertaken until the power revenues are assured and a suitable contract for repayment of the investment in irrigation works within 40 years has been executed by the district.

DESCRIPTION OF PROJECT

As considered in this report the proposed Columbia Basin project, located adjacent to and east of the Columbia River in eastern Washington, is a combination of power and irrigation development. The fundamental requisite for either power or irrigation is the construction of a dam in the Columbia River at the so-called Grand Coulee site shown on drawing No. 222–D–14. The Columbia River dam is to be 4,100 feet long and will raise the water about 355 feet above the low water surface of the river. It will create an artificial lake 150 miles long extending to the Canadian boundary line. The total height of the dam above the general elevation of the foundation will be about 450 feet.

Hydraulic and electrical machinery is to be installed progressively at the dam for the generation of power. It is contemplated that the firm power will be sold at the dam to responsible agencies engaged in the distribution of electrical energy. Pumping machinery for irrigation requirements is to be installed progressively at the dam and this machinery will utilize the seasonal power available during the high water season of the Columbia River.

Water for the irrigation project is to be pumped from the Columbia River reservoir through large discharge pipes to the Grand Coulee Canal extending a distance of 1.7 miles to Grand Coulee Lake. This lake will be created by the construction of two dams, one at the north end of the Grand Coulee near the Columbia River, and the other near the south end of the Grand Coulee about 4½ miles north of Coulee City. This lake will be about 23 miles long and the difference between the high water surface in the Grand Coulee Lake and

the low water surface of the Columbia River reservoir will be about 362 feet.

From the south end of the Grand Coulee Lake, water is conducted through concrete lined canals, concrete lined tunnels, steel pipe siphons, and reinforced concrete pipe siphons to the lateral distribution system which finally delivers water to 981,000 acres of land, including that part of the area considered suitable for irrigation and cultivation. There are a number of places where the larger canals are dropped to lower elevations and the energy of the falling water at such places is to be utilized for repumping to areas lying at a maximum elevation of 100 feet above the canals. This repumping will add an additional irrigable area to the project of 219,000 acres making the total irrigable area of the project 1,200,000 acres.

PREVIOUS INVESTIGATIONS

The possibilities of irrigating the area along the Columbia River in Grant, Adams, and Franklin Counties in eastern Washington received consideration and investigation by the United States Reclamation Service as early as 1904. Surveys were made for canals using the Columbia, Spokane, and Palouse Rivers as sources of water supply. A total of $76,400 was spent on these early investigations. The Priest Rapids area was investigated in 1905 at a cost of $6,200.

Again in 1914 and 1915, under a cooperative agreement between the State of Washington and the United States Reclamation Service, an investigation and report was made on a proposed project north and east of Pasco, Wash., using the Palouse River as a source of water supply. This work was in charge of Engineer McCulloch and involved an expenditure by the United States Reclamation Service of $10,200.

Studies by the United States Reclamation Service on the possibilities of power development on the Columbia River at various times prior to 1923 involved an expenditure of $4,000.

The Columbia Basin commission of the State of Washington of which Marvin Chase, State hydraulic engineer, was chairman, and A. J. Turner, of Spokane, was chief engineer, published a report in 1920 as a result of its surveys and investigations in that year and in 1919. The commission investigated a number of plans for the project water supply, including several alternatives of a gravity supply diverting from Clark Fork at Albany Falls, a partial water supply from the Wenatchee River and a plan for pumping water from the Columbia River at the Grand Coulee site with a dam in the Columbia River 180 feet in height above low water.

A board of engineers of the United States Reclamation Service, consisting of D. C. Henny, James Munn, and C. T. Pease, reviewed the report of the Columbia Basin commission of the State of Washington in December, 1920. The report of this board suggested a number of changes in unit prices and recommended further investigations.

The State of Washington in 1921 made further investigations at the Columbia River dam site and explored the foundation by diamond drilling. Estimates were made of the costs of developing power, pumping water for irrigation, and building transmission lines at the Foster Creek site and also at the Grand Coulee site. The estimates and report of this work were prepared by Willis T. Batchellor,

electrical engineer. In the latter part of 1921, the State of Washington employed Gen. George W. Goethals to review existing reports and to make a further report upon the feasibility of the various construction problems of the project. His report dated March 30, 1922, showed considerably lower unit costs than had been used by the Columbia Basin commission. The cost of work done by the state on completion of this report amounted in round numbers to $150,000.

A board of engineers consisting of J. S. Cavanaugh, colonel, Corps of Engineers, United States Army, D. C. Henny, consulting engineer, United States Reclamation Service, F. F. Henshaw, district engineer, United States Geological Survey, C. S. Heidel, State engineer of Montana, W. G. Swendsen, commissioner, Department of Reclamation, Idaho, and Marvin Chase, supervisor of hydraulics, State of Washington, made a report to the Federal Power Commission in February, 1923. The principal conclusions of this board of engineers as given in the published report were that the Columbia Basin propect was the most important single item to be considered in the uses to be made of the Columbia River water above the mouth of the Snake River, that the project could be supplied with water by either a gravity supply diverted from the Clark Fork at Albany Falls or by pumping from the Columbia River at the Grand Coulee dam site but that information upon which to base a final decision between a gravity and a pumped supply for the Columbia Basin irrigation project was not complete and should be completed.

The United States Bureau of Reclamation made further investigations of the Columbia Basin project in 1923 and 1924, and the report thereon by Engineer H. J. Gault was published by the Senate of the Sixty-ninth Congress, second session, for the use of the Committee on Irrigation and Reclamation. This report considered four alternatives in each of the two general plans for irrigating the Columbia Basin project. The gravity plan was investigated with high and low lines, each with and without repumping. The pumping plan proposing a dam in the Columbia River at the Grand Coulee site, 280 feet in height above low water, was investigated with and without storage, and with and without repumping. Soils, geology, and water were considered in their relation to the project.

A board of engineers consisting of A. J. Wiley, James Munn, and J. L. Savage of the United States Bureau of Reclamation, reviewed the above mentioned Gault report and on April 6, 1924, submitted a report which was published with the Gault report. The board found that the construction cost of irrigation under the pumping plan of lowest cost would be $246.58 per acre, as against $231.40 per acre under the gravity plan of lowest cost. The board in arriving at the cost of $246.58 per acre for the pumping project considered that the power market in the territory was so fully covered by private and municipal developments that no net income could be relied upon from the sale of power to offset the greater cost of both construction and operation of the pumping over the gravity plan. It was judged that the entire cost of the dam in the Columbia River, that part of the power plant required for irrigation pumping, the pumping plants and transmission lines necessary for repumping on the project, amounting to 47.7 per cent of the total cost, would have to be borne by the irrigation project in addition to the construction items for the distribution of water and drainage of the lands.

In 1924 a board of engineers and economists was appointed by the Columbia Basin commission of the United States Department of the Interior to make a further study of the Gault report and an independent investigation of the project including settlement and farm development problems as well as engineering. The Columbia Basin commission was appointed by the Secretary of the Interior and its membership consisted of Elwood Mead, Commissioner of the Bureau of Reclamation and John H. Edwards, Solicitor of the Department of the Interior.

The membership of the board of engineers appointed by the Columbia Basin commission consisted of Louis C. Hill of California, Charles H. Locher of Maryland, Richard R. Lyman of Utah, Arthur J. Turner, O. L. Waller, and Joseph Jacobs of Washington. The report of this board dated February, 1925, was published with the Gault report. This board found that economic conditions seemed so definitely to favor the gravity projects that it did not deem it necessary to make an elaborate analysis of the entire Columbia River power problem and consequently limited its examination and report to the analyses and estimates of the various plans of supplying water to the Columbia Basin project by diverting water from the Clark Fork at Albany Falls. The board gave consideration to the carrying capacity of the canals and in addition to providing for concrete lining in all canals dawn to 100 cubic feet per second capacity, proposed to line with concrete all laterals below 100 cubic feet per second capacity and by such construction estimated that the diversion duty would be increased from 80 acres to the second-foot as used in the Gault report to from 112 to 119 acres to the second-foot for the maximum and minimum project, respectively. With the above as a basis, the board found the minimum gravity project of 1,224,000 acres could be constructed at a cost of $158 per acre. It concluded that with the construction of the project the State should assume its proper share of the responsibility for collecting payments from the settlers and should also bear its proper share of the losses, if any, incidental to the development of the project.

The Columbia Basin commission transmitted the above-mentioned report of the board of engineers and economists to the Secretary by letter of August 25, 1925, and this letter was published with the reports above mentioned. The commission concluded that the time had not arrived when local and national interests justified the construction of the project or that the Bureau of Reclamation was possessed of either the information or the experience needed to formulate a development program as costly and complex as the one outlined and advocated in the report. The cost of all investigations of the Columbia Basin project made by the United States Bureau of Reclamation up to this time exclusive of those for which the costs have heretofore been mentioned amounted in round numbers to $97,000.

From 1926 to the early part of 1930, studies of various water supply and power development problems relating to the Columbia Basin project were made by the United States Geological Survey at the request of and collaborating with the State of Washington. The principal reports submitted are as follows:

(1) Power Possibilities of Priest River, Idaho, 1926, by G. L. Parker, district engineer, United States Geological Survey, and Eugene Logan, consulting engineer, for the State of Washington.

(2) Preliminary Report Columbia Basin project, Water Power Analysis 1926, by G. L. Parker, district engineer, United States Geological Survey, and Eugene Logan, consulting engineer for the State Department of Conservation and Development.

(3) Storage Regulation in Flathead Basin for Power and its Effect on the Columbia Basin project, 1926, by G. L. Parker, district engineer, United States Geological Survey.

(4) Albany Falls Power Project in connection with Columbia Basin Irrigation Project, 1930, by Eugene Logan, consulting engineer for the State Department of Conservation and Development, Washington.

A very comprehensive investigation of the Columbia River and its tributaries above the mouth of the Snake River was made during 1928, 1929, 1930, and 1931, by the Corps of Engineers of the War Department. The results of this investigation were submitted in 1931 in a report by Maj. John S. Butler, district engineer in charge of the work. This report consists of two volumes and five appendices. It considers navigation, flood control, irrigation, and power development. In addition to a number of able officers and civilian employees of the War Department, skilled specialists were employed for the study of the problems in economics, geology, dam design, power, and irrigation development. A large amount of data were assembled on climate, vital statistics, population trends, markets, lumbering, mineral resources, irrigation economics, and power installations, and a study of this information was made to determine the probable success of the irrigation project and the future requirement for electrical energy including that required for the development of the irrigation project.

With particular reference to the irrigation project under the pumping plan, a study and estimate was made of dams of various heights at the Grand Coulee site in the Columbia River. Estimates were made of seven different plans for irrigating the entire project and of two plans for irrigating a part of the project. The following gives the essential features of the various plans:

Source of water supply river	Name of area to be irrigated	Acres supplied					Acres, total
		By gravity only	By pumping 362 feet at Grand Coulee	By repumping 100 feet	By pumping 255 feet	By pumping 635 feet	
Wenatchee	Quincy	320,310	0	0	0	0	320,310
Columbia River 10 miles above Priest Rapids.	South of Saddle Mountain.	0	0	0	74,100	66,420	140,520
Clark Fork and Spokane.	Maximum project.	1,256,940	0	262,950	0	0	1,519,890
Clark Fork	do	1,256,940	0	262,950	0	0	1,519,890
Clark Fork and Wenatchee.	Gravity project only.	1,256,940	0	0	0	0	1,256,940
Clark Fork, Spokane, Wenatchee.	Reduced gravity project.	1,129,380	0	320,310	0	0	1,449,690
Columbia River at Grand Coulee Dam.	Maximum pumping project.	0	980,340	219,090	0	0	1,199,430
Columbia River at Grand Coulee and at 10 miles above Bend.	South of Saddle Mountain and part of pumping project and repumping.	0	834,860	199,250	74,100	66,420	1,174,630
Columbia River at Grand Coulee.	South of Saddle Mountain and part of pumping project.	0	834,860	0	74,100	66,420	975,160

IRRIGABLE AREAS

Irrigable areas as referred to in this report are those lands which are expected to produce good crops when cultivated and irrigated. The irrigation of these areas will require lifting the water from the Columbia River Reservoir to the Grand Coulee Lake through a maximum height or primary lift of 362 feet for 981,000 acres and relifting the pumped water an additional height of 100 feet for 219,000 acres.

All irrigable lands of the project will be served by the main canal which extends southward from the Grand Coulee Lake about 11.7 miles to a point where it branches into two canals, the main west and the main east.

The main west canal extends in a westerly and southerly direction beyond Ephrata and Quincy and with its lateral distributaries supplies water to 371,000 acres all of which are under the primary lift and no areas along the west main canal are to be irrigated by repumping.

The main east canal extends in a southeasterly direction beyond Hatton and Connell and with its lateral distributaries supplies water to a total of 829,000 acres. Of this area 219,000 acres are to be supplied by repumping and while some high areas lying between the boundaries defined by the main canal lines will be supplied by repumping the greater portion of the area lies adjacent to the east of the east main canals.

Extensive areas within the project boundaries have been eliminated from the irrigable areas for various reasons such as elevation, probable waterlogging, rocks, gravel, etc. These determinations have been made by field inspections using as a guide United States Geological Survey maps on scales of one-half inch and 1 inch to 1 mile where they had been made. In order to make a more dependable determination of the irrigable areas topographic maps should be made on a scale of 400 feet or 1,000 feet to 1 inch and test pits and borings should be made to determine the character and thickness of the soils and subsoil conditions particularly as the latter may relate to future waterlogging of the soil.

WATER SUPPLY

Stream flow.—The Columbia River above the proposed Columbia River dam drains a roughly triangular shaped area of 74,000 square miles located in parts of British Columbia, Idaho, Montana, and Washington. The main source of water supply for the river is from the melting of the abundant snows accumulated at the higher altitudes on the western slope of the Rocky Mountains and on the Selkirk and Bitterroot Mountains. A number of large lakes located near the headwaters, of which the principal ones are Kootenay Lake in British Columbia, Flathead Lake in Montana, and Pend Oreille, Priest, and Coeur d' Alene Lakes, in Idaho, tend to regulate the flow of the river naturally by retarding the flood peaks and storing large volumes of water for release when the river and lake stages recede following the flood runoff. It is possible that at some future date the outflow from these lakes may be controlled artificially for power purposes thus creating a greater regulatory effect than

now exists. When and if such regulation should be accomplished, the winter flow of the Columbia River and hence the firm power possibilities at the Columbia River reservoir site would be increased somewhat over that shown herein. Plans for the development of the Columbia Basin project make no allowance for such artificial control of these upstream reservoirs, hence, for the purposes of this report, no allowance is made for such additional regulation.

Discharge records, from which estimates of the flow at Grand Coulee are based, are available as follows:

At Trail, British Columbia, May, 1913, to March, 1931.
At Kettle Falls (or Marcus), Wash., April, 1916, to March, 1931.
At Grand Coulee, Wash., July to December, 1923, and June, 1928, to March, 1931.
At Vernita (or Wenatchee), Wash., May, 1913, to March, 1931.

In addition, records are available for the principal tributaries, which enter the main stream in this section. Using these records, reliable estimates of flow at Grand Coulee were prepared for the period April, 1913, to March, 1931. (See Table No. 1.)

TABLE No. 1.—*Department of the Interior, Bureau of Reclamation*

Run-off of Columbia River at Grand Coulee; unit, 1,000 acre-feet; drainage area, 74,100 square miles

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
1913							4,030
1913-14	3,800	3,080	2,370	2,230	1,930	2,970	5,930
1914-15	3,840	3,910	2,970	2,010	1,600	2,260	5,150
1915-16	3,120	2,920	2,430	1,750	1,820	3,860	6,720
1916-17	3,730	2,750	1,990	1,610	1,440	1,560	3,330
1917-18	3,750	2,400	2,570	5,150	2,890	2,800	5,510
1918-19	3,980	2,830	2,320	2,180	2,410	2,620	5,250
1919-20	2,850	1,800	1,430	1,440	1,460	1,800	2,610
1920-21	5,340	3,830	2,830	2,910	2,580	3,830	5,510
1921-22	3,150	3,180	2,880	2,100	1,520	1,670	3,190
1922-23	3,360	2,330	1,620	2,360	1,460	1,740	4,420
1923-24	2,960	1,950	1,740	1,430	2,290	2,350	2,460
1924-25	2,900	2,750	2,460	2,540	3,490	3,360	8,200
1925-26	2,880	1,930	1,770	1,590	1,680	2,050	3,870
1926-27	3,650	3,690	3,680	2,520	2,170	2,600	3,610
1927-28	6,520	6,400	5,630	3,690	2,940	3,550	5,500
1928-29	3,200	2,460	1,970	1,550	1,180	1,570	2,310
1929-30	2,530	1,740	1,460	1,160	1,280	1,750	4,220
1930-31	2,770	1,940	1,650	1,390	1,350	1,970	

Year	May	June	July	Aug.	Sept.	Total
1913	11,700	25,900	17,200	9,590	5,950	74,370
1913-14	13,500	17,400	15,500	8,120	4,580	81,410
1914-15	10,800	11,200	11,300	9,590	5,430	70,060
1915-16	12,400	19,000	25,800	11,600	6,550	97,970
1916-17	11,300	21,900	19,200	9,160	4,810	82,780
1917-18	12,900	18,300	15,700	8,360	5,380	85,710
1918-19	12,500	17,500	13,900	8,480	4,800	78,770
1919-20	8,610	14,100	19,400	10,900	5,400	71,800
1920-21	13,600	23,200	15,400	8,480	4,170	91,680
1921-22	9,650	21,100	13,400	7,810	5,270	74,920
1922-23	11,600	20,400	15,800	8,360	5,500	78,950
1923-24	11,200	13,500	10,300	7,060	4,920	62,160
1924-25	17,000	19,700	15,300	8,520	4,550	90,770
1925-26	10,300	8,260	8,710	5,550	4,240	52,830
1926-27	11,400	21,800	18,500	9,950	7,400	90,970
1927-28	16,800	21,100	16,000	8,850	4,680	101,660
1928-29	7,130	16,100	10,300	6,820	4,140	58,730
1929-30	9,840	13,200	12,000	7,620	4,580	61,380
1930-31						11,070

NOTE.—Actual records available at station during periods July to December, 1923, and July, 1928, to March, 1931; balance of time discharges estimated from other records available at Trail, British Columbia, Kettle Falls, Wash., and Vernita, Wash. Estimated flows for period, April, 1913, to January, 1924, published in United States Geological Survey Water Supply Paper No. 572. Estimated flows for period, February, 1924, to June, 1928, based on discharges of Columbia River at Kettle Falls and intervening tributaries between Kettle Falls and Grand Coulee.

During this period the flow at Grand Coulee has varied from 17,000 second-feet to 492,000 second-feet, with an average of 109,000 second-feet, corresponding to an average annual run-off of 79,000,000 acre-feet.

There has been very little additional irrigation development on the upper tributaries of the Columbia River during the past 18 years, so that the flow as recorded in Table No. 1 represents the flow under present conditions. However, by the time the Columbia Basin project has been fully developed, additional irrigation development may deplete the present flow of the stream by about 1,000,000 acre-feet annually.

In the Gault report of 1924, the amount of such depletion due to future irrigation development above the dam site was estimated at about 900,000 acre-feet annually.

The irrigable areas and amount of depletion have been estimated by the Army engineers as follows (part 2, Appendix 2):

Location of irrigable lands	Area in acres	Estimated annual depletion, acre-feet
Above Flathead Lake	125,000	160,000
From Priest Lake	20,000	25,000
Between Flathead Lake and Lake Pend O'Reille	290,000	492,000
Between Lake Pend O'Reille and Grand Coulee, exclusive of Spokane River	170,000	272,000
From Spokane River	20,000	28,000
Total	625,000	977,000

In addition to the above lands there is an irrigable area of about 66,000 acres on the Rathdrum Prairie in Idaho which would receive a water supply from either Priest Lake or Lake Pend O'Reille. Making due allowances for this area and also for the areas now under irrigation in the Columbia River watershed, the estimated depletion for additional irrigation and incidental storage development have been taken as 1,000,000 acre-feet annually, as follows (units acre-feet):

February	10,000	August	160,000
March	20,000	September	70,000
April	90,000	October	10,000
May	150,000	November	20,000
June	260,000		
July	250,000	Total	1,000,000

Irrigation requirements.—On account of the variety of soil and climatic conditions on the Columbia Basin project, the crops grown and the water requirements will vary markedly on the different localities. On the whole, however, it is believed that crops and water requirements will be similar to those on the Sunnyside Division of the Yakima project.

The physical features of the two projects compare as follows:

Feature	Sunnyside division Yakima project	Columbia Basin project
Mean annual temperature	51.2° [1]	50.4° [2]
Mean temperature April–October.	61.6° [1]	62.2° [2]
Annual precipitation	0.55 foot [1]	0.68 foot. [2]
Precipitation, April–October.	0.24 foot [1]	0.30 foot. [2]
Average frost-free period	157 days [1]	159 days. [2]
Elevation irrigated area	800 feet	500 to 1,400 feet.
Soil type	Largely deep sandy loam and light volcanic ash. Small areas of decomposed basalt underlain by gravel.	Largely deep soil, varying in texture from fine silty loam to sandy loam. Small areas of shallow sandy soil underlain by gravel.
Annual irrigation requirements delivered to farm.	3.44 acre-feet per acre [3]	Estimated 3.25 acre-feet per acre.

[1] Climatological record at Sunnyside.
[2] Mean of climatological records at Lind, Hatton, Wheeler, Ephrata, and Quincy.
[3] Mean for period 1919 to 1930, inclusive.

From the above tabulation it is noted that while the Columbia Basin project area has slightly higher temperatures in the growing season and a little longer frost-free period than the Sunnyside division, it also receives more precipitation and the soils as a whole are more retentive of moisture than those on the Sunnyside division. In view of these facts the average irrigation requirements on the Columbia Basin project have been estimated at 3.25 acre-feet per acre annually.

Plans for the irrigation of the proposed project contemplate that all main canals and laterals having in excess of 100 second-feet capacity will be lined and also lining laterals below 100 second-feet capacity when indications point to excessive losses, thereby materially saving water that would otherwise be lost by seepage. Some water will still be lost, however, on account of regulatory waste, evaporation loss in the main canals, and laterals and seepage losses from the smaller laterals. The total amount of such losses in the distribution system has been estimated at 25 per cent of the water diverted into the main canals.

Opportunities for the reuse of return flow are not so good on this project as would be expected on an area of this size, due to the fact that the coulees which form the natural drainage channels of the project are deep and to recover such return flow would require additional pumping. The Gault report of 1924, estimates that a maximum of 512 second-feet could be reused out of Lind Coulee with the pumping plan fully developed with repumping lifts. For this report it is estimated that an average of 500 second-feet of return flow could be used with the fully developed project.

Based on the foregoing discussion the net diversion requirements from the Grand Coulee Reservoir, for irrigation water for the fully developed area, would be as follows:

TABLE NO. 2.—*Net diversion requirements from Grand Coulee Reservoir for fully developed Columbia Basin project*

Month	Rate of delivery, acre-feet per acre	Rate of diversion, acre-feet per acre	Total diversions for fully developed area, units 1,000 acre-feet (1)	Less usable return flow, units 1,000 acre-feet (2)	Net irrigation demand on Grand Coulee Reservoir, units 1,000 acre-feet
April	0.39	0.55	660	27	633
May	.51	.67	805	33	772
June	.58	.74	888	36	852
July	.60	.76	912	37	875
August	.55	.71	852	35	817
September	.39	.55	660	27	633
October	.23	.35	420	17	403
Total	3.25	4.33	5,197	212	4,985

(1) Total irrigable area, 1,199,430.
(2) Average of 500 second-feet, April to October, inclusive, distributed throughout year in same proportions as total diversions.

Grand Coulee Reservoir.—The irrigation plan provides for a reservoir to be created in Grand Coulee by the construction of two dams, which will serve as part of the main conduit and eliminate a very expensive portion of the main canal which would otherwise be necessary to convey the water past that vicinity, and will also provide regulatory storage as hereinafter explained.

At various times during the past 11 years geological examinations have been made to determine the suitability of the Grand Coulee Reservoir site and the probable extent of leakage therefrom. Unpublished geological reports of this site are available as follows:

July, 1921, by O. P. Jenkins and H. H. Cooper.
March, 1924, by Kirk Bryan.
October, 1930, by Henry Landes.
November, 1930, by Ira A. Williams.
December, 1930, by F. L. Ransome.

That portion of the Grand Coulee proposed to be used as a reservoir site has walls composed largely of basalt. Within the flow line of the proposed reservoir, except for the extreme ends of the coulee and at a few places along the side walls, the basalt is covered by unconsolidated talus slopes, sands, gravels, and silt terraces. The floor of the coulee, except for the southern end where basalt is exposed and near the northern end where some granite is exposed, is covered by silts which are underlain by sand and gravel.

All of the geologists who reported on this reservoir agree that the most likely place for serious leakage to occur is at the southern end of the reservoir site, where a steep monoclinal fold occurs in the basalt. The inclined flows and the more permeable contacts between the successive flows along which water could percolate are exposed in the sides and bottom of the coulee. There is some disagreement as to the extent of such leakage; Cooper and Jenkins believe that the sharp folding of the basalt was accompanied by faulting along which water could readily escape; Williams believes that, while no general faulting occurred, the folding caused some fractures in the

adjacent basalt; Bryan, Landes, and Ransome recognize the possibility of leakage along the inclined contacts between the flows and apparently believe that such fractures as may be accompanied by the folding are superficial or will be sealed by the silt which covers the bed of the reservoir.

Ransome and Bryan believe that an underground hydraulic gradient exists from the plateaus toward the reservoir basin so that the pressure thus created would prevent the movement of water from the reservoir toward the sides. Mr. Williams, on the other hand, believes that a general hydraulic gradient exists from the east to west, so that while the raising of the water level would not be sufficient to reverse the gradient to the east, it would cause a steeper gradient to the west. He states that seepage along the west side of the reservoir would be limited by the permeability of the wall; in this connection he points out the possibility of fractures existing, especially at the southern end near the monoclinal fold.

All of the geologists contemplated a maximum flow line elevation of 1,552.5 feet in the reservoir, while present plans contemplate a maximum flow line elevation of 1,570 feet.

In view of the impossibility of determining in advance, the extent of the reservoir leakage, such leakage has been very conservatively estimated as 1,000 second-feet (corresponding to about 1 inch loss per day) for the purposes of this report.

With the project fully developed, the water surface elevation in the Grand Coulee Reservoir will fluctuate between 1,570 and 1,554.8 feet, thereby creating a storage capacity of 329,000 acre-feet which could be utilized to carry the irrigation requirements for short intervals in case it should become necessary to interrupt the pumps during the irrigaton season. This storage would be useful in carrying a large part of the irrigation demand during April of each year at a time when the proposed Columbia River Reservoir would be down to low levels, during periods of subnormal run-off. The pumping draft and power required for pumping would be reduced as a result of this useable storage in Grand Coulee Reservoir.

A preliminary study of the joint operations of the Columbia River and Grand Coulee Reservoirs during critical periods of low run-off such as occurred during the winters of 1919–20 and 1929–30, shows that a minimum reduction in firm power output at the Columbia River Reservoir would occur if the Grand Coulee Reservoir were maintained at elevation 1,570 throughout the winter until the end of March and then allowed to drop to elevation 1,554.8 during April.

In May and the succeeding months there is always a surplus of water available at the Columbia River Reservoir, so that the pumping plants could be run continuously at full capacity and the storage in Grand Coulee Reservoir replenished as rapidly as possible.

While the operation of this reservoir could be varied from year to year to best fit in with the available power and water levels in the Columbia River Reservoir for that year, it has been assumed in these studies that the Grand Coulee Reservoir stages would vary as outlined above for each year. Based on the above discussion and the irrigation demands set forth in Table No. 2, the net amount of water to be pumped from the Columbia River Reservoir and

the elevations to which such water must be pumped are set out in Table No. 3.

TABLE No. 3.—*Net irrigation demands on Columbia River for fully developed Columbia Basin project*

[Units, 1,000 acre feet]

Month	Irrigation demand at Grand Coulee Reservoir (1)	Losses from Grand Coulee Reservoir (2)	Storage content of Grand Coulee Reservoir at end of month	Water pumped from Columbia River to Grand Coulee Reservoir	Elevation to which water must be pumped—feet (3)
January	0	61	1,050	61	1,570
February	0	56	1,050	56	1,570
March	0	61	1,050	61	1,570
April	633	60	721	364	[4] 1,563
May	772	61	872	[5] 984	[4] 1,563
June	852	60	912	[5] 952	1,564
July	875	61	960	[5] 984	1,566
August	817	61	1,050	968	1,570
September	633	60	1,050	693	1,570
October	403	61	1,050	464	1,570
November	0	60	1,050	60	1,570
December	0	61	1,050	61	1,570
Total	4,985	723		5,708	

[1] From Table No. 2.
[2] Estimated at 1,000 second-feet.
[3] Corresponds to elevation of W. S. in Grand Coulee Reservoir except as noted.
[4] Minimum elevation to which water must be pumped fixed by conditions at outlet of pump discharge pipe.
[5] Pumps operated at full capacity of 16,000 second-feet.

Preliminary studies show that a dam in Grand Coulee, 10 feet higher than contemplated herein, would furnish additional storage which could be used to further reduce the pumping requirements from Columbia River during the winter months and thereby increase the firm power available at that site from 800,000 kilowatts to 840,000 kilowatts. However, in order to accomplish this, about 1,000 second-feet of additional pumping capacity and a corresponding increase in the power installation would be required at the Columbia River Dam to care for the additional pumping requirements to insure filling the reservoir during the period May to August, when a surplus of water is available in the Columbia River. In addition, raising of the water level in the Grand Coulee reservoir would tend to increase the possibilities for leakage of such reservoir. Before final plans are made for this reservoir more detailed studies should be made to determine the best capacity to which it can be developed safely and economically.

Columbia River reservoir.—The determination of the economic height for the Columbia River Dam requires the proper balancing of the costs for pumping into the Grand Coulee reservoir, the costs of power for pumping, the cost and value of power for commercial uses, the value of lands and power sites submerged by the reservoir and other important factors.

Based on preliminary studies of these factors, the "high dam" as proposed in the Army report was tentatively adopted and the studies reported herein are based on this dam, which will raise the

water level to elevation 1,287.6 feet and create a reservoir in the stream channel about 150 miles long, with a water area of about 120 square miles (77,000 acres). The plan as outlined herein contemplates that, in the wintertime, the reservoir will be drawn down a maximum of 80 feet, thereby making available 5,028,000 acre-feet of storage in years of low run-off for the production of firm power.

Evaporation losses from this reservoir would occur largely in the period from May to September inclusive, when there is always more than enough water to fully meet irrigation and power requirements, hence no allowance has been made for evaporation losses in the operation studies of this reservoir.

Very little information is available upon which to determine the extent of seepage losses from the Columbia River Reservoir. The fact that the reservoir would occupy the river channel, which is largely cut into indurated rocks indicates that seepage losses from the reservoir would be negligible and they have been so assumed in this study.

The tailwater elevation below the proposed power plant at the dam has been assumed to vary with the discharge as at present and ranges from about elevation 933.5 feet with a discharge of 19,000 second-feet to about elevation 981 feet with a discharge of 450,000 second-feet.

Power output.—A study of reservoir operations using monthly estimates of inflow and outflow during the critical periods of low run-off such as occurred in the winters of 1919–20 and 1929–30 shows that with the reservoir drawn down 80 feet there would be sufficient flow to maintain a uniform power output of 920,000 kilowatts, if there were no irrigation and pumping demands for the Columbia Basin project. Further study shows that with the irrigation project fully developed, pumping requirements would reduce the firm power output to 800,000 kilowatts. In this study the overall efficiency of the power plant was taken as 83 per cent and that of the pumping plant as 73 per cent.

A study was made of the joint operations of the Grand Coulee and Columbia River Reservoirs with stream flows as estimated for the period April, 1913, to March, 1931, inclusive. The results of this study are shown graphically on drawing 222–D–5. In this study whenever the Columbia River Reservoir was full, it was assumed that all water, in excess of that pumped to the Grand Coulee Reservoir, to the extent of the power plant capacity (1,575,000 kilowatts) would be passed through the power plant for the production of secondary energy. When the reservoir was not full the releases through the power plant were limited to the water required for the production of firm power and power required for pumping.

The average amounts of the various kinds of power available each year are as follows:

TABLE No. 4.—*Various kinds of power available each year*

Year Apr. 1 to Mar. 31	Total power—millions of kilowatt-hours			Months in which secondary power is available [1]
	Firm power	Power required for pumping	Secondary power available for sale [1]	
1913–14	7,008	2,260	1,840	May to March.
1914–15	7,008	2,230	2,460	April to December.
1915–16	7,027	2,240	2,150	April to December and March.
1916–17	7,008	2,230	1,780	April to November.
1917–18	7,008	2,260	2,460	May to March.
1918–19	7,008	2,230	2,280	April to March.
1919–20	7,027	2,260	1,460	April to September.
1920–21	7,008	2,330	2,820	June to March.
1921–22	7,008	2,230	1,890	April to December.
1922–23	7,008	2,250	1,120	May to November.
1923–24	7,027	2,250	1,040	May to September.
1924–25	7,008	2,250	2,210	May to March, except October.
1925–26	7,008	2,230	1,450	April to September.
1926–27	7,008	2,250	2,320	May to March.
1927–28	7,027	2,240	3,850	April to March.
1928–29	7,008	2,230	1,620	April to November.
1929–30	7,008	2,320	700	June to September.
1930–31	7,008	2,330	890	May to September.
Mean	7,013	2,260	1,910	

[1] Available only when reservoir is full. Reservoir spills every year so that if a market should arise for such power in the future more could be generated by providing a larger power-plant capacity.

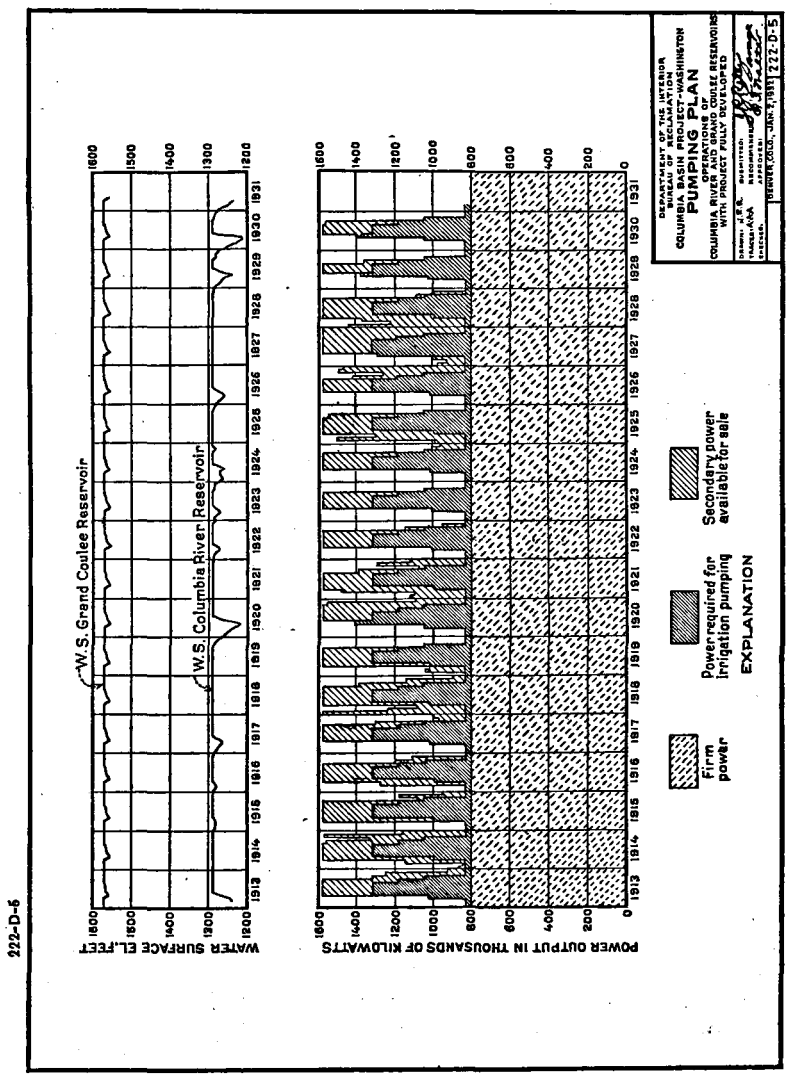
COLUMBIA RIVER DAM

Scope of investigation.—The geological conditions at the site have been studied by Geologist Kirk Bryan and are covered in his report which is included in the Gault report of 1924. Between July 9, 1921, and January 9, 1922, 14 diamond drill holes were put down at this site by the Columbia Basin Survey Commission. Two additional drill holes were put down in 1930 by the Corps of Engineers, United States Army. The geological report and the record and interpretation of drill holes form the basis for present assumptions as to foundation conditions. The foundation area is so extensive and there is such a deep covering over bedrock that there is much uncertainty as to the actual foundation conditions. A large amount of additional testing is necessary to make a reasonably complete exploration of the foundations. The purpose of additional drilling and testing would be to define the surface of the bedrock more completely over the whole area comprising the foundation of the dam and power plant, to determine the depth of unsound rock necessary to remove and to determine the presence of major seams or fault zones within the area. To obtain the necessary additional information, the following program of further diamond drilling and testing has been proposed.

Drilling 48 vertical holes, 8,400 linear feet; drilling 10 inclined holes, 8,000 linear feet; trenching 550 linear foot open trench; excavating 4 test pits averaging 150 feet deep.

Estimated cost of additional foundation exploration necessary is $150,000.

Highways.—The Columbia River dam site can be reached by unimproved roads from Mansfield 35 miles west, from Almira about 20 miles southeast on the Sunset National Highway (U. S. 10); and also by a gravel-surfaced county highway going north through



Grand Coulee from Coulee City, located approximately 30 miles southwest of the dam site.

Construction railroad.—No location surveys for a construction railroad have been made. However, there appears to be two feasible routes to the dam site, one connecting with the Great Northern Rail-

road at Mansfield, 35 miles west, and the other connecting with the Northern Pacific Railroad near Coulee City. A construction cost estimate of a railroad following the latter route was prepared from incomplete United States Geological Survey topography. In addition to providing transportation for the construction of the Columbia River Dam, the Grand Coulee route will also pass near the sites of the proposed north and south Grand Coulee Dams of the proposed Grand Coulee Reservoir. This route will also provide for transportation of concrete aggregates from deposits of this material already accessible by railroad between Coulee City and Hartline, and north of Adrian.

The proposed line, approximately 30 miles in length, will branch from the main line of the Northern Pacific Railroad, near Coulee City Junction, and follow the east side of Grand Coulee at an elevation slightly above the flow line of the proposed Grand Coulee Reservoir to a point opposite the North Grand Coulee Dam, from where the line descends to the west end of the Columbia River Dam.

Transportation of concrete aggregates.—For the purpose of estimating the delivered cost of concrete aggregates, it was assumed that the contractor would continue the construction of the railroad down the canyon from the switchback location to a point approximately 2 miles below the dam where the river would be bridged and the railroad constructed upstream to gravel deposits on the east side of the river. It is also practicable to transport concrete aggregates to the mixing plant by an aerial tramway system consisting of several units or lines.

Construction power.—An ample supply of electric power for construction purposes is available from transmission lines of the Washington Water Power Co. which pass through Coulee City. A 60,000-volt branch line to Spokane runs parallel to the tracks of the Northern Pacific Railroad, which at a point west of Almira and directly south of the dam site, is but 16 miles distant across the Hartline Plateau.

Concrete materials.—With the cooperation of the district engineer, Corps of Engineers, United States Army, Seattle, Wash., preliminary field investigations were made of sand and gravel deposits immediately adjacent to the dam site and of several deposits more remotely situated. Approximately 100 material samples of about 100 pounds each, after removal of cobbles larger than 6 inches, were obtained from the various deposits and shipped to the Bureau of Reclamation laboratory at Denver for test. Brief descriptions of the deposits, the work performed, and the general findings are given in the following paragraphs.

Deposits at dam site.—Extensive bench deposits are located on the east side of Columbia River, adjacent to the dam site. Eight test pits from 21 to 41 feet deep and 10 side-hill trenches from 35 to 66 feet in vertical projection, covering an area about 1 mile north and one-half mile south of the dam center line, were excavated and logs prepared. The average depth of overburden is about 3½ feet. The aggregate material lies in horizontal strata, differing widely in gradation, and interspersed with layers of clay at depths of 21 feet or more. Lime-coated and discolored material is found in one test pit. The material is fairly well rounded and generally dirty. It is composed largely of basalt (70 to 80 per cent), with lesser amounts

of granite, shale, quartzite, diorite, and andesite. A small percentage of the basalt is vesicular. The aggregate is apparently sound with the exception of the shale. A total of 89 test samples were taken.

The deposit at the dam site may prove to be a practicable source of aggregate for the dam. Accessibility, apparent soundness and freedom from organic impurities of the material, and the satisfactory size range and gradation of the coarse aggregate are characteristics in its favor. Thorough washing would be essential for removing excess silt, disposing of the softer pieces of shale, and avoiding the formation of clay balls. The extreme variations in gradation of the sand, even in the same pit, point to the possible need for division of the same into two or three sizes and recombination in desired proportions. Without such separation, the high average fineness modulus of the washed sand would require correction, by one of a number of possible means. While the tabular values for average pit run proportions show a large excess of sand, it is probable that the actual average percentage of sand is materially less, due to the fact that thick layers of coarse material, especially in the trenches, were not sampled and had to be disregarded in arriving at the figures stated. Additional investigations would be required to obtain more reliable data and to definitely establish the sufficiency of the deposits.

Mansfield pit.—This pit is located in sec. 35, T. 30 N., R. 29 E., about 10 miles in direct line northwest of the Columbia River dam site. It is apparently a small deposit containing relatively fine material only. The material is similar in composition and shape of particles to that at the dam site. Only one sample was taken.

The Mansfield deposit, considered alone, is apparently of little value for the purpose, owing to its limited extent, the large proportion and high fineness modulus of the sand, and a pronounced deficiency in the larger sizes of gravel.

Adrian pit.—This is an extensive deposit located along the Northern Pacific Railroad about 1 mile north of Adrian and 42 miles in direct line southwest of the dam site. The face of the deposit is about 600 feet long and 75 feet high, with the lower half covered by talus. The material is apparently clean, structurally sound, and fairly well rounded. It is composed entirely of basalt with vesicles present in 15 to 25 per cent of the coarse aggregate. Four samples were taken from the upper half of the face.

The Adrian deposit is handicapped by its distance from the dam site, its excess of sand, and the relatively high fineness modulus of the sand. The deposit is apparently clean and extensive and, with the exception of the deposits at the dam site, shows the most favorable gradation of coarse aggregate.

Hartline pit.—This is an extensive deposit located along the Northern Pacific Railroad and the power line of the Washington Water Power Co. about 21 miles in direct line southwest of the dam site. It lies about 6 miles east of Coulee City and 3 miles west of Hartline. The exposed face of the deposit is about 500 feet long and 30 feet high and the pit is covered with an earth overburden about 4 feet deep. The material is apparently clean, structurally sound and fairly well rounded. It is composed entirely of basalt with vesicles prominent in 30 to 50 per cent of the coarse aggregate. The face

of the pit was logged and four samples taken. A second deposit with similar material was found about 1½ miles west.

If the data obtained may be taken as representative, the Hartline deposit, although similar in many respects, is much less favorable than the Adrian deposit by reason of the very high proportion of sand, the exceptionally high fineness modulus of the sand, and the lower fineness modulus of the gravel.

Results of tests on aggregate.—Sieve analyses, silt determinations, and calorimetric tests were made in the Denver laboratory on all of the above-mentioned samples. Some concrete tests are contemplated. The principal results of the completed tests are tabulated below:

TABLE NO. 5.—*Analysis of concrete aggregates*

	At the dam site			Adrian pit	Hartline pit	Mansfield pit
	8 pits	10 trenches	Entire deposit			
Average pit-run proportions:						
Sand, to ¼ inch.....per cent	36	50.1	42.9	55.6	83.2	70.5
Washed gravel, ¼ inch to 6 inches .....per cent	64	44.3	52	41.7	14.0	26.4
Calorimetric tests, unwashed sand	(1)	(1)	(1)	(1)	(1)	(1)
Silt content, by weight of unwashed sand:						
Minimum.....per cent	.9	.9	.9	2.3	3.4	1.9
Maximum.....do	72.4	44.6	72.4	2.8	4.4	1.9
Weighted average.....do	6.1	5.3	5.6	2.7	3.7	1.9
Fines removed in washing sand, by weights: Weighted average...per cent	11.25	10.05	10.6	3.81	3.84	4.21
Fineness modulus of sand, washed:						
Minimum	1.81	1.64	1.64	3.32	4.12	3.73
Maximum	4.57	4.94	4.94	3.68	4.52	3.73
Weighted average	3.17	3.40	3.30	3.38	4.14	3.73
Fineness modulus of gravel:						
Minimum	7.06	6.0	6.0	7.18	7.11	7.25
Maximum	9.17	8.70	9.17	8.39	8.04	7.25
Weighted average	8.32	8.19	8.26	7.78	7.46	7.25
Grading of gravel, weighted average for entire deposit:						
3-inch sieve	13.1	7.5	10.5	48.3	9.8	0
1½-inch sieve	47.5	47.3	47.4	27.70	25.4	7.6
¾-inch sieve	77.4	72.0	74.9	58.60	42.2	39.8
⅜-inch sieve	94.0	92.4	93.2	86.90	68.6	77.5
No. 4 sieve	100.0	100.0	100.0	100.0	100.0	100.0

[1] Favorable.

NOTE.—Depth of layers and proportions of sand and gravel were taken into account in determining "weighted averages" values.

Foundation conditions.—Knowledge of foundation conditions at the dam site is limited to the information secured by a geological examination and the drilling of 16 diamond-drill holes. On the basis of information it is believed that the surface of bedrock lies at approximately elevation 880 across the valley and rises with side slopes of about 1½ to 1 to the elevation of the crest of the dam. The foundation rock over the whole area is described as a medium gray, fine grained, hard, dense granite, with joints at intervals of 2 to 6 feet. There is no shattering or crushing at joints and the presence of the joints will facilitate quarrying and excavating the rock. Open joints were found to depths of 35 feet but it is believed that these joints can be successfully sealed by grouting. The cores indicated that 5 to 10 feet of rock was unsound and should be removed from the valley floor and that 10 to 15 feet should be removed from the rock surfaces on the slopes. From 20 to 70 feet of fine-grained

clay lies above the bedrock. This is believed to be impervious and it should afford a watertight connection between the sheet piling of the cofferdams and the bedrock. A mixture of clay, sand, and gravel is found above this clay stratum, varying from a few feet up to one hundred feet. The presence of the clay just above the granite will undoubtedly simplify the foundation work and aid in keeping water out of the excavation but at the same time the clay may tend to squeeze out under the weight of the overburden and this condition will affect the design of the cofferdams from the standpoint of stability.

Two depressions in the surface of the bedrock were disclosed in the drilling, one at elevation 790 and another at elevation 780. Sufficient drilling has not yet been done to determine the shape and extent of these depressions but they are believed to be potholes in an old stream bed or else depressions eroded by glacial action. There are no surface indications of faults within the area of the site. The large amount of river deposit over the valley floor necessitates enormous quantities of foundation excavation.

Diversion of river during construction.—The care of the Columbia River during construction of the dam presents a difficult problem owing to the large discharges that must be passed. During the period in which there are records giving the flow at the dam site, the maximum daily average flow is found to be 496,000 cubic feet per second. In the period of record 17.83 years, the mean daily maximum flow exceeded 450,000 cubic feet per second during three different periods and these aggregate only 42 days.

The diversion works will be carried out in two main stages. The first stage includes the excavating of a diversion channel along the east bank of the river; the driving of a cellular sheet pile cofferdam to rock, parallel to and adjacent to the east bank of the river; and the turning of the river into the diversion channel by means of timber cribs sunk in the main channel between the west bank of the river and the ends of the cellular cofferdam. The upstream cribs will be built to elevation 795 which is estimated to pass 600,000 cubic feet per second without overtopping the cofferdam. After completing the excavation within this first cofferdam the concrete will be brought up to elevation 1,025, except the alternate blocks across the spillway section which will be left at elevation 950 for the passage of flood water. In addition to these low blocks thirty-one 12-foot diameter temporary openings will be left through the dam for the passage of flood water.

The cofferdams of the second stage of the diversion plan will extend from the east bank of the river to the ends of the sheet pile cellular cofferdam. These will be raised to elevation 1005 which is estimated to divert 450,000 cubic feet per second through the openings left in the west portion of the dam. After the excavation is completed the concrete in the east section of the dam will be poured to elevation 1,025. Fourteen additional temporary 12-foot diameter holes will be placed in this section which, together with the 20 permanent 5 foot 8 inch by 10 foot outlets, will provide enough spillway capacity to pass 50,000 cubic feet per second after the 15 holes through the power-house section of the dam have been closed, without overtopping the low blocks at elevation 950. This will give

two months time at least in the low-water season for raising the low blocks. A number of the low blocks will be kept low at all times until the drum gates are installed.

The temporary 12-inch diameter openings will be utilized until the spillway crest is completed after which they will be plugged with concrete. A steel bulkhead will be provided for closing each of these openings to facilitate the pouring of the concrete plug.

Description of dam and appurtenances.—The Columbia River Dam is located on the Columbia River near the head of Grand Coulee in section 1, T. 28 N., R. 30 E., and section 6, T. 28 N., R. 31 E. It is a straight concrete gravity dam 450 feet high and 4,100 feet long at the elevation of the roadway on top of the dam.

The spillway consists of an overflow section of the dam, across the river channel, with an overall length of 1,918 feet. The spillway discharge assumed to be a maximum of 1,000,000 second-feet, is controlled by fourteen 124 by 28 foot structural-steel drum gates. The drum gates will be designed for automatic control, hand-operation, or remote control from the power plant. With 1,000,000 second-feet discharge over the spillway, the water surface in the reservoir will be at elevation 1,289.6, causing a 30-foot depth on the crest of the spillway. The energy of the spillway water will be dissipated on a sloping concrete apron. This apron will be designed to create a hydraulic jump at all stages of the tailwater. The final design of this apron will be determined by hydraulic model tests. The spillway will be bridged by 14 concrete arches, providing a 24-foot roadway, these arches being supported on concrete piers 14 feet thick carried up from the overflow crest structure.

Sluiceway openings are placed through the dam on the right side of the spillway at elevations 935, 1,050, and 1,165 for emergency and diversion purposes. Twenty 5 foot 8 inch by 10 foot conduits are shown on the drawing at elevation 935. These conduits have a discharge capacity of 30,000 second-feet with water surface in the reservoir at elevation 965. The drawings also show eight 5 foot 8 inch by 10 foot conduits at elevation 1,050 and likewise at elevation 1,165. All of these sluiceway conduits are controlled by tandem 5 foot 8 inch by 10 foot hydraulically operated slide gates.

The Columbia River is the main artery for fish migrations between the tributaries and the Pacific Ocean and for this reason the problem of passing fish through or over the dam is of utmost importance. A mechanical fish elevator, somewhat similar to that used on the Baker Dam has been tentatively selected as the most practicable type for fish traveling in an upstream direction. This elevator will raise the fish from the head end of a flume, located adjacent to the draft tubes, up to the crest elevation of the dam and will then lower them into the reservoir. The fish elevator consists principally of a flume extending the full width of the tailrace along the downstream side of the power plant, together with a fish elevator operating from the head of the flume upward through an inclined shaft to the crest of the dam and downward through a second inclined shaft to the reservoir.

As the possibility of navigation of the Columbia River is very remote, due to the great expense involved in improving the river below the dam, no design or cost for locks has been included in this report.

The meager information available relative to property damage within the reservoir basin does not warrant the preparation of a detailed estimate at this time. This item of cost is included in a general estimate for reservoir right-of-way.

POWER PLANT

Buildings and structures.—The power house is located on the downstream toe of the dam to the left of the spillway section. The building is a concrete and steel structure 1,028 feet long and 78 feet wide with the 220,000-volt transformer equipment located between the power-house superstructure and the dam. The generator-room floor has been placed at an elevation just above the maximum recorded tailwater elevation, but the entire building is made watertight to an elevation several feet above an assumed maximum flood water condition.

All low voltage switching equipment, governor oil pumping equipment, and the passages for carrying water, oil, and air piping and power busses and cables are located in the substructure of the building. Two house generators are located at the extreme left-hand end of the plant at which point there is also dismantling space for the units and a machine shop for handling repair work. The building contains two cranes having a combined capacity sufficient to lift the heaviest part of any generating unit.

A control house containing the control equipment for both power house and pumping plant is located apart from the power house adjacent to the left end of the building.

Water is supplied to the turbines through a concrete and steel trash rack structure on the upstream side of the dam. An individual penstock controlled by a stoney gate at the upper end is provided for each main generating unit. The penstock openings have their center lines at elevation 1180. The steel penstocks pass through the dam at this elevation and then follow the downstream face of the dam to the turbines in the power house. A Gantry crane is provided on the top of the dam for handling penstock gates and other equipment.

Hydraulic and electrical machinery.—Fifteen main generating units of 105,000 kilowatt-capacity each are proposed for the power plant. The turbines are rated at 147,000 horsepower each at 330 feet head and the generators are rated at 120,000 kilovolt-amperes each at 120 revolutions per minute, 22,000 volts, 60 cycles, 87.5 per cent power factor. An individual governing system including actuator, oil pump, and oil tank is provided for each turbine and each generator has a direct-connected exciter.

Each generating unit has its own transformer bank for raising th voltage to 220,000 and switching and protection equipment has been included for one outgoing transmission line per generating unit. In addition, five of the generators are equipped with oil circuit breakers, cables and control equipment for supplying power to the twenty pumps which are proposed for the ultimate installation in the pumping plant.

Annual costs.—The annual cost of operation and maintenance of the power plant has been taken at 50 cents per kilowatt of installed capacity for the ultimate development or $785,000. For the purpose

of financial studies it has been assumed that the annual operation and maintenance cost of the initial development consisting of three units will be one-third of the cost of the complete development and will increase uniformly as additional units are installed. The annual operation and maintenance cost for the dam has been taken as $150,000.

Depreciation for both dam and power plant has been taken on an assumed average 30-year life for all items considered depreciable. An annuity has then been set up which when invested at 4 per cent will accumulate the required amount for replacement at the end of a 30-year period. On this basis the required annuity is 1.78301 per cent of the original cost of the depreciable items.

These annual costs are summarized in the following tabulations:

COMPLETE DEVELOPMENT

Depreciation:	
Cost of depreciable items for dam	$9,911,685
Cost of depreciable items for power plant	34,753,633
Total in dam and power plant	44,665,318
Annuity required, at 1.78301 per cent	796,387
Operation and maintenance:	
Dam	150,000
Power plant at $0.50 per kilowatt	787,500
Total	937,500

INITIAL DEVELOPMENT

Depreciation:	
Cost of depreciable items for dam	9,911,685
Cost of depreciable items for three units in power plant	9,563,176
Total in dam and power plant	19,474,861
Annuity required, at 1.78301 per cent	347,239
Operation and maintenance:	
Dam	150,000
Power plant, one-third of $787,500	262,500
Total	412,500

ULTIMATE IRRIGATION DEVELOPMENT

Columbia River pumping plant.—The pumping plant building is located along the reservoir shore line just upstream from the left abutment of the dam. It is a reinforced concrete structure about 640 feet long by 100 feet wide with practically all the building below water when the reservoir is at maximum elevation. A Gantry crane will travel the entire length on top of the building and will give access to the machinery through removable hatchways placed over the pumping units. Drainage for the interior of the structure is secured by means of a drainage tunnel leading to a gravity outlet in the tailrace below the power plant. This tunnel will also carry the power cables from the power plant to the pumping plant for the operation of the pump motors. A concrete and steel trash-rack structure occupies the entire reservoir side of the building.

Twenty pumping units are proposed for the ultimate installation, each unit consisting of a single stage pump, having a capacity of 800 second-feet when operating under a total head of 370 feet, direct

connected to a 33,000-horsepower, 22,000-volt, synchronous motor operating at 200 revolutions per minute. The motor capacity is such that with a full reservoir one main generating unit in the power plant has sufficient capacity to operate four pumping units and with a minimum reservoir elevation one main generating unit has sufficient capacity for operating three pumping units. This coordination of generator and pumping unit capacities allows full independent use of each generating unit for operation of the pumping units, and also permits variation in the speed of the units so as to maintain the pump efficiency at the highest possible point throughout a large variation in pumping head.

A separate steel discharge pipe is provided for each pump and these pipes are supported on concrete foundations and located above ground so that they are accessible for inspection, painting, and other maintenance work. All pipes lead to a common outlet structure at the head of the Grand Coulee Canal and each is equipped with a siphon arrangement containing an automatic air valve to prevent reverse flow of water from the canal when the operation of a pump is stopped.

Repumping.—In order to utilize as fully as practicable the power possibilities on the project and to relieve the demand on Columbia River power it is proposed to develop power for pumping purposes at those favorable places on the irrigation project where on account of the topography and for other reasons it is advisable to drop the canal grades to lower elevations. Power plants are to be constructed at these drops and the seasonal electricity generated is to be transmitted to a number of pumping plants located at various places along the canals where water will be pumped to a total of 219,090 acres lying above the gravity canals. Transmission lines are to be constructed connecting the various power plants and supply lines will be extended to the pumping plants.

Size of installations.—With 3.25 acre-feet of water delivered at the land during the irrigation season and 15 per cent loss in distribution in the canals supplying the pumping areas, the pumping duty is 3.82 acre-feet per acre, or a total seasonal requirement of 836,924 acre-feet for 219,090 acres. With an average pumping head of 70 feet, the acre-feet feet pumped during the season is 58,584,680. The installations required for the various heads and canal capacities are as follows:

	Kilowatt installation
50 per cent, or 29,292,340 acre-feet feet	1,000
30 per cent, or 17,575,404 acre-feet feet	500
10 per cent, or 5,858,468 acre-feet feet	250
5 per cent, 2,929,234 acre-feet feet	100
5 per cent, or 2,929,234 acre-feet feet	10–50

Estimated costs of repumping.—The estimated costs of the repumping installations are as follows:

Transmission lines and transformers:	
180 miles of primary line 66,000-volt copper-treated wood poles, at $2,800 per mile	$504,000
150 miles of secondary line, 11,000-volt copper-treated wood poles, at $1,800 per mile	270,000
26,000 kilowatts in transformer capacity, at $2.50 per kilowatt	65,000
	839,000

Power development: 26,000 kilowatts, at $60	$1,560,000
Pumping plants:	
Buildings, hydraulic equipment, pipe lines and electric equipment, not including step-down transformers—	
29,292,340 acre-feet feet, at 0.065 per acre-foot foot	1,904,002
17,575,505 acre-feet feet, at 0.085 per acre-foot foot	1,493,909
5,858,458 acre-feet feet, at 0.10 per acre-foot foot	585,847
2,929,234 acre-feet feet, at 0.14 per acre-foot foot	410,093
2,929,234 acre-feet feet, at 0.25 per acre-foot foot	732,308
	5,126,159
Total for repumping	7,525,159

Grand Coulee Reservoir.—It is proposed to construct earth dams at the north and south ends of the Grand Coulee. Water pumped from the Columbia River will discharge into the Grand Coulee and be controlled as to elevation and use by the dams and regulating works.

The formation of a lake in the Grand Coulee 23 miles long, having an area of 2,300 acres at the maximum water-surface elevation of 1,570, eliminates the necessity for a very expensive canal along the steep walls of the Grand Coulee and saves the loss of about 47 feet in the elevation of the water surface at the south end of the Coulee. It also allows a more efficient use of water for power development and irrigation by providing storage for water which can be pumped when the supply in the river is ample, and in turn decreases the amount of power water required for pumping when the river supply is low.

North Grand Coulee Dam.—The North Grand Coulee Dam, located about 1½ miles from the Columbia River Dam on Grand Coulee, together with the South Grand Coulee Dam located about 4½ miles north of Coulee City, will be constructed to form the Grand Coulee Reservoir, which is an important link in the main canal system. The site of the North Grand Coulee Dam has been explored with six drill holes, and the foundation conditions, as revealed thereby, have determined the selection of an earth-fill dam for this site. The dam section has been designed with unusually flat slopes. The upstream two-thirds will be constructed as a sprinkled and rolled earth fill while the downstream one-third will consist of a gravel fill with a rock-paved slope and a flat downstream toe. The slope on the water side will be protected with 30 inches of rock riprap laid on 12 inches of gravel. A concrete cut-off wall 10 feet high will extend throughout the length of the dam. On the earth parts of the foundation the concrete cut-off wall is set in a cut-off trench 20 feet deep and is built on top of a row of steel sheet piling. The rock sections of the foundation, together with the basalt abutment and intake canal section, will be drilled and grouted along the line of the cut-off wall. The maximum height of the dam above the original ground surface will be 92 feet. About 10 feet of foundation excavation over the lower parts of the old stream bed is believed to be necessary. An emergency wasteway, controlled by a 50 by 50 foot Stoney gate, provides an outlet to the Columbia River. A 12-foot embankment freeboard is provided for this dam and an additional 3 feet of freeboard against high waves is provided by means of a concrete parapet wall on the crest of the dam.

South Grand Coulee Dam.—Because of uncertainty in the bearing power and watertightness of the earth foundations at this site,

an earth dam section with flat slopes, similar in most respects to the North Grand Coulee Dam section has been adopted. A gravel fill will be used instead of a rock fill at the downstream toe because there will be only small quantities of excavated rock available from required excavations at this site. A cut-off trench, concrete cut-off wall and steel-sheet piling are provided on the earth foundation as in the North Grand Coulee Dam. It is estimated that 18 inches of stripping will be required over the earth portion of the foundation area. The height of the maximum section of the dam above the original ground surface will be 97 feet and an embankment freeboard of 12 feet is provided together with a 3-foot concrete parapet wall. A Stoney gate 50 feet wide and 36 feet high controls the outflow into the main canal heading at this dam.

Canals.—There are included under this item all canals having a carrying capacity in excess of 100 cubic feet per second. The maximum amount of water which they will carry is dependent upon the acreage which they serve and is intended to be sufficient for the period of maximum demand after allowing for leakage and waste. With the exception of the canal supplying Grand Coulee Lake, the capacities are computed as follows:

In excess of 100,000 acres, 1 cubic foot per second to 80 acres.
Between 100,000 acres and 50,000 acres, 1 cubic foot per second to 70 acres.
Between 50,000 acres and 25,000 acres, 1 cubic foot per second to 65 acres.
Between 25,000 acres and 6,000 acres, 1 cubic foot per second to 60 acres.

Larger carrying capacities are provided in the smaller canals than in the larger canals in order to provide a more satisfactory rotation system when necessary.

The capacity of the canal supplying Grand Coulee Lake is greater than the canal leading from the lake in order to provide for the estimated rate of leakage from the Grand Coulee Lake and at the same time supply the maximum irrigation demand. During the times of diminished irrigation demand this extra capacity provided will allow an accumulation of storage in the lake. All canals are to be lined with reinforced concrete varying in thickness from a maximum of 12 inches to a minimum of 4 inches. The classification of materials of excavation on all canal lines is based principally on field inspection. Borings and test pits would give a closer estimate of the classification, but the estimate as made is believed to be reasonably close.

Tunnels.—The capacities of all tunnels are determined in the same manner as the canals above mentioned. They are designed of the horseshoe type with a depth of water at 83 per cent of the diameter. The tunnels will be lined throughout with concrete. No reinforcing is provided in the tunnel lining except in the closed transition sections at the inlets and outlets. Tunnel excavations will be mainly in basaltic rock but provision is made in the estimate for some timbering.

Siphons and penstocks.—It is proposed to carry the required water supply across streams and coulees by means of reinforced concrete pipes where the pressure head and capacities required are relatively small. Where greater capacities and larger diameters are required, steel pressure pipes are proposed. Steel pipes are also proposed for the power penstocks and pump discharge pipes at those places on

the project where drops in the canal grades occur and where repumping is contemplated.

The steel pipes are designed to rest on concrete saddles and to have concrete anchors where necessary. Depreciation is calculated as an annuity that would replace the steel pipes in 30 years at 4 per cent or providing a reserve fund in the annual operating and maintenance budget of the irrigation project an amount to be determined by taking 1.78 per cent of the original investment in the steel pipes.

Lateral system.—All distributaries of less than 100 cubic feet per second capacity are included in the lateral system which is intended to deliver water to each 160-acre farm. Where these ditches are excavated in gravel or other porous material which would allow considerable leakage, it is proposed to line such stretches with reinforced concrete. The lateral system under the main west canal is believed to require a relatively small amount of concrete lining and concrete drops and is estimated to cost $21 per acre. Under the main east canal the amount of concrete lining will be greater, and this portion of the lateral system is estimated at $25 per acre.

Drainage.—There are a number of places on the irrigation project where ditches will have to be constructed to carry off waste and seepage water and to provide outlet channels for wasteways from the canals. Frequently a wasteway channel affords an outlet for drainage ditches. As the wasteways deemed necessary are considered as a separate item and so estimated, although they really act as drainage outlets, the item and estimate of $4 per acre for providing drainage is intended to cover those cases where lateral drains are necessary and to provide additional outlets where necessary.

Wasteways.—Wasteways are necessary on any irrigation project to provide a means of disposing of water during emergencies such as cloudbursts or canal breaks and to afford a means of regulating the water supply close to the land. This allows closer regulation on shorter notice, which is important with a long canal system such as the one under consideration. The wasteway channels deemed necessary will, in addition to carrying off waste water occurring by regulation, provide outlets for drainage ditches as mentioned above.

Buildings.—The operation and maintenance of the irrigation project requires a number of permanent buildings such as offices, shops, warehouses, residences for reservoir superintendents and headgate keepers, and the estimate provides an amount to cover their cost. These buildings are in addition to the temporary buildings to be built by the contractors during the construction period. The cost of such temporary buildings is included in the estimates of the various items which necessitate their construction. This item for permanent buildings does not cover the cost of buildings required for the power-plant and pumping-plant operators, as the cost of such buildings is included in the items covering those features.

Telephone system.—The operation and maintenance of the irrigation project will require a great many miles of telephone lines, in order that daily reports of the use and expected demands for water service may be communicated promptly to the employee whose duty is to see that the required amount of water is kept in the canal for prompt and efficient service. The estimate provides for the construction of 400 miles of metallic circuit carried on 25-foot poles with treated butts.

Wells.—A separate estimate is given for this item in order to obviate the necessity for using different prices for the same class of concrete required throughout the project. The cost of the concrete in place is influenced by the availability of the water supply and an estimate is provided for wells in order to make the distance to a water supply practically constant.

Operation and maintenance during construction.—When the water is first turned into the canal, there will be items of expense occurring on account of developments which can not be entirely eliminated beforehand at reasonable expense. After a few years these difficulties are remedied, and usually remain so for the life of the project. While these improvements are being made during the operation of the project they are really items of construction, and an allowance is made in the construction estimate to cover the cost of such work.

Summary of estimate of cost of Columbia Basin project for ultimate development

Relevant data:	
Power-plant installation—horsepower	2,100,000
Primary power—do	1,067,000
Pumping-plant installation—do	660,000
Area to be irrigated—acres	1,200,000
Capacity primary pump installation cubic-foot-seconds	16,000
Columbia River Dam	$125,750,000.00
Columbia River power plant	42,616,000.00
Total cost dam and power plant	168,366,000.00
Primary pumping plant	8,890,000.00
Repumping plants	7,525,000.00
Grand Coulee Lake	8,703,000.00
Canals	79,307,000.00
Tunnels	22,778,000.00
Siphons	37,595,000.00
Lateral system	28,516,000.00
Drainage	4,800,000.00
Buildings	1,484,000.00
Telephones	240,000.00
Wasteways	2,230,000.00
Wells	200,000.00
Operation and maintenance during construction	5,997,000.00
Total cost of irrigation project	208,265,000.00
Total cost Columbia Basin project	376,631,000.00
Total per acre cost irrigation project	173.55
Total per acre cost irrigation project per year	4.34

FIRST UNIT IRRIGATION DEVELOPMENT

The development of the first irrigation unit of 150,000 acres, known as the Quincy area, involves the least investment possible in pumping machinery, pipe lines, dams, canals, and structures necessary to give dependable service to the area, but at the same time includes all of the works required in the beginning, so that every part of the initial investment, with the possible exception of the small dam and a short length of canal at Coulee City, will be utilized in the ultimate development of the irrigation project. It is proposed to develop this 150,000-acre unit in blocks of 20,000 acres per year, the first 20,000

acres to be irrigated the year following completion of construction of the Columbia River Dam. The character of the construction proposed is described by features which are shown on drawing No. 222–D–14, as follows:

Feature No. 1.—The Columbia River Dam completed to full dimensions is required.

Feature No. 2.—The initial installation of the pumping plant requires the construction of the entire pump-house substructure, the installation of the Gantry crane for handling the pumping machinery and the installation of four pumping units. Each pumping unit consists of a vertical-shaft, double-suction, single-stage, centrifugal pump of 800 cubic feet per second capacity direct connected to a 35,000 horsepower synchronous motor. Each pump will be connected through a manifold to a steel discharge pipe 8½ feet in diameter and 750 feet in length, the upper end of which will discharge into the Grand Coulee Reservoir supply canal, or feature No. 3. No repumping is contemplated for the initial irrigation unit.

Feature No. 3.—The canal leading from the end of the pipe line at the Columbia River Dam to the North Grand Coulee Dam in the Grand Coulee is to be constructed to dimensions required for the ultimate capacity of 16,000 cubic feet per second and is to be lined throughout with reinforced concrete.

Feature No. 4.—The North Grand Coulee Dam in the Grand Coulee is to be constructed to the height and dimensions required for ultimate development or of height to store water to elevation 1570.

Feature No. 5–A.—At the south end of the Grand Coulee it is proposed to construct a small dam at what is known as the Coulee City dam site. This dam is to be constructed to the height necessary to supply sufficient water depth in the canal to irrigate the Quincy area. The construction of this dam allows the impounding of water in Grand Coulee to elevation 1542.5, and will provide a relatively inexpensive method of testing the water tightness of the coulee. In case the leakage is found to be negligible with this test dam at Coulee City, the dam can then be enlarged to allow storage of water to elevation 1570.0 which is the elevation required for ultimate development. In case the water loss in Grand Coulee Reservoir is found to be excessive with the test dam at Coulee City, this site can be abandoned and a dam (feature No. 5) constructed at a site 4 miles further up the coulee. In this event there will be a loss of $676,000 in the Coulee City Dam, additional right of way and incidental expenses, and a loss of $224,000 in the temporary canal and headworks described hereafter as Feature No. 6–B. However, in case the dam at Coulee City proves successful, there will be no need for the more expensive dam further north (feature No. 5) and there will be a saving of $7,496,000 which is the difference between the cost of the upper dam and the longer canal (feature No. 6) leading to it as compared with the cost of the lower dam and its additional requirement for right of way and a shorter length of canal (feature No. 6–A plus feature No. 6–B).

Feature No. 6–B.—A temporary canal about 3,500 feet long branching from the proposed permanent canal (feature No. 6) which latter extends from the proposed permanent South Coulee

Dam to Bacon siphon, is to be constructed of sufficient dimensions without concrete linings to carry the water required (1,875 cubic feet per second) to irrigate 150,000 acres.

Feature No. 6–A.—Only that portion of the canal (feature No. 6) will be constructed which extends from Bacon siphon on the south to the above-mentioned temporary canal (feature No. 6–B) on the north. Feature No. 6–A is to be constructed of full dimensions required for the ultimate development but the reinforced concrete lining is to be omitted in the initial development.

Feature No. 7.—The Bacon siphon as proposed for ultimate development consists of two parallel lines of steel pipes supported upon concrete cradles and anchors. It is proposed to construct one line completely. This will give excess carrying capacity for the first unit but when due consideration is given to the hydraulic properties of the canals required for ultimate development, it is not believed that a better arrangement can be provided.

Feature No. 8.—The Bacon Tunnel as proposed for ultimate development consists of two parallel tunnels lined throughout with unreinforced concrete. The route of this tunnel line is through basalt rock. It is proposed to construct one tunnel to full dimensions. No concrete lining is proposed for the first unit and the tunnel will deliver the water required when running about one-half full.

Feature No. 9.—The open canal between Bacon Tunnel and Trail Lake Tunnel is to be constructed to dimensions required for ultimate development but the reinforced concrete lining is to be omitted.

Feature No. 10.—Trail Lake Tunnel as proposed for ultimate development consists of two parallel tunnels. The same plan is proposed for constructing Trail Lake Tunnel for unit development as was mentioned above.

Feature No. 11.—For the ultimate development of the project, a concrete structure is proposed at the point where the main canal branches into two parts, designated the main west and the main east canal. No structure is proposed at this point for the first development as no part of the main east canal is to be built and the main west canal, which is to be constructed, is merely a continuation of the main canal.

Main west canal.—The main west canal is to ultimately serve 371,000 acres. The first unit selected for development lies wholly under the main west canal. It is proposed to omit the construction of lateral W–1 and its branches, but lateral W–2 and lateral W–3, and branches of both these laterals, are to be constructed to full dimensions including reinforced concrete lining. The main west canal and all tunnels and siphons (features Nos. 1 to 7, inclusive) are to be constructed for the ultimate capacity. Construction of the main west canal will stop at the point where lateral W–3 branches off the main west about 7 miles east of Quincy.

As only a part of feature No. 8 is required, that portion which must be constructed to serve the first irrigation unit is designated as feature No. 8–A.

General items.—In the estimate which follows, provision is made for the cost of the lateral system, drainage, wasteways, telephones, wells, buildings, and operation and maintenance during construction.

Summary of estimate of cost of first unit of Columbia Basin project

Relevant data:	
Power plant installation—horsepower	2,100,000
Primary power—do	1,067,000
Pumping plant installation—do	132,000
Area to be irrigated—acres	150,000
Capacity pump installation—cubic foot seconds	3,200
Columbia River Dam	$125,750,000.00
Columbia River power plant	42,616,000.00
Total cost dam and power plant	168,366,000.00
Primary pumping plant	4,004,000.00
Grand Coulee Lake	3,820,000.00
Canals	13,994,000.00
Tunnels	4,338,000.00
Siphons	3,770,000.00
Lateral system	3,150,000.00
Drainage	600,000.00
Buildings	187,000.00
Telephones	30,000.00
Wasteways	270,000.00
Wells	26,000.00
Operation and maintenance during construction	750,000.00
Total cost of irrigation project	34,939,000.00
Total cost Columbia Basin project	203,305,000.00
Total per acre cost irrigation project	232.92
Total per acre cost irrigation project per year	5.82

Estimates showing comparison of costs of different plans of Grand Coulee Reservoir together with the costs of changes in canals and headgates required for the various plans

Plan No. 1, using test dam at Coulee City:	
North Grand Coulee Dam	[1] $2,070,000
Right of way	[1] 1,274,000
Additional right of way required for test dam	[1] 275,000
Coulee City test dam	[1] 201,000
Raising Coulee City test dam	1,634,000
Temporary canal and headgate, feature No. 6–B	[2] 224,000
Shorter length of main canal used (feature No. 6–A) with test dam	[2] 1,926,000
Concrete lining, temporary canal, and larger headgate for ultimate capacity if test dam proves satisfactory	436,000
Total cost	5,970,000
Plan No. 2, using dam 4 miles above the test dam without first using test dam:	
North Grand Coulee Dam	2,070,000
Right of way	1,274,000
Upper south dam in Grand Coulee	4,683,000
Canal headgate (feature No. 6) leading to upper south dam	5,439,000
Total cost	13,466,000

[1] These items make up total Grand Coulee Lake cost for initial development.
[2] These items are included in cost of canals for initial development.

Plan No. 3, using dam 4 miles above the test dam after first building the low-test dam of Coulee City and in case it proves unsatisfactory:	
North Grand Coulee Dam	[3] $2,070,000
Right of way	[3] 1,274,000
Additional right of way purchased for Coulee City test dam	[3] 275,000
Coulee City test dam	[3] 201,000
Temporary canal and headgate (feature No. 6–B)	[4] 224,000
Emptying reservoir below elevation 1,520 by pumping	[3] 200,000
Upper south dam in the Coulee	[3] 4,683,000
Canal and headgate (feature No. 6) leading to upper south dam	[4] 5,439,000
Total cost	14,366,000

Annual costs.—The annual depreciation, operation, and maintenance costs for the primary pumping plant have been set up on the same basis as for the power plant using a 30-year average life for the depreciable items and 50 cents per kilowatt of capacity installed for operation and maintenance. The costs are summarized in the following tabulations:

Full development

Depreciation:	
Cost of depreciable items	$5,896,597
Annuity required at 1.78301 per cent	105,137
Operation and maintenance: 500,000 kilowatts, at $0.50	250,000

Initial development

Depreciation:	
Cost of depreciable items	1,442,639
Annuity required at 1.78301 per cent	25,722
Operation and maintenance: One-third of ultimate $250,000	83,300

OPERATION AND MAINTENANCE COST

The following gives an analysis of the estimated annual operation and maintenance expense of the irrigation project and includes items for depreciation reserves to replace steel pipes, etc.:

Depreciation:	
Primary pumping plant and pipe line 1.78[1] per cent of $5,896,597	$105,137.00
Repumping power plants, pumping plants 1.78[1] per cent of $7,525,159 and transmission lines	133,747.00
Depreciation on buildings, 5 per cent per annum on $1,499,000	74,950.00
Depreciation on telephones, 1.78[1] per cent of $240,000	4,272.00
Depreciation on pipe siphons and penstocks, 1.78[1] per cent of $22,538,800	401,190.00
Total depreciation	719,296.00
Total depreciation, per acre	.60

[1] Assuming 30-year life and an annuity set aside at 4 per cent, requires 1.78 per cent per annum on depreciable item.

[3] These items make up the total Grand Coulee Lake cost for ultimate development.

[4] These items are included in cost of canals for ultimate development.

If test dam and its enlargement is satisfactory, the saving over plan No. 2 is $7,496,000. If the test dam is unsatisfactory the extra expense involved is shown by the difference between plan No. 2 and plan No. 3, or $900,000.

Operation and maintenance:	
Primary, pumping plant, at 50 cents per kilowatt	$250,000.00
Secondary power plants, at $2 per kilowatt (26,000)	52,000.00
Secondary pumping plants, at $3 per kilowatt (26,000)	78,000.00
Transmission lines, at $50 per mile (330 miles)	16,500.00
Telephone lines, at $25 per mile (330 miles)	10,000.00
Total operation and maintenance exclusive of irrigation distribution system	406,500.00
Total operation and maintenance exclusive of irrigation distribution system, per acre	.34
Total of depreciation and operation and maintenance, exclusive of irrigation distribution system	1,125,796.00
Per acre, for 1,199,430 acres	.94
Purchase of electricity for primary pumping at $1 per acre per annum	1.00
Operation and maintenance of irrigation distribution system per acre	1.25
Total annual charges exclusive of construction repayment	3.19

ANNUAL CONSTRUCTION REPAYMENTS

In the financial study (Table No. 6) to determine how the investment is to be repaid it has been estimated that the land, beginning four years after the completion of the Columbia River Dam and power plant, and four years after the beginning of irrigation of each completed division will pay $2 per acre per year for four years and thereafter pay $2.50 per acre per year for 32 years. In this manner each division or block of land irrigated will pay out in 40 years an amount which, when added to the estimated proportional power surplus, will liquidate its proportionate share of the irrigation investment.

TABLE 6.—*Financial operation of irrigation development of Columbia Basin project*

Year after completion of dam	Acres settled	Repayments fifth to eighth year after settlement at $2 per acre	From lands ninth to fortieth year after settlement at $2.50 per acre	Repayment from power surplus at 2.25 mills per kilowatt-hour	Total repayment for year	Total cost of irrigation construction at beginning of year	Cost of irrigation construction during year	Investment remaining in irrigation development at end of year	Return from power surplus available for other purposes	Accumulated return from power surplus used for repayment of irrigation	Accumulated average return per acre from power surplus for 1,199,430 acres	Accumulated return from power surplus available for other purposes
1	20,000					$33,822,000	$783,000	$34,605,000				
2	40,000					34,605,000	749,000	35,354,000				
3	60,000					35,354,000	915,000	36,269,000				
4	80,000					36,269,000	975,000	37,244,000				
5	100,000	$40,000			$40,000	37,244,000	931,000	38,135,000				
6	120,000	80,000			80,000	38,175,000	537,000	38,592,000				
7	140,000	120,000			120,000	38,712,000	1,306,000	39,778,000				
8	160,000	160,000			160,000	40,018,000	1,584,000	41,202,000				
9	180,000	160,000	$50,000		210,000	41,602,000	284,000	41,276,000				
10	200,000	160,000	100,000		260,000	41,886,000	3,327,000	44,343,000				
11	220,000	160,000	150,000		310,000	45,213,000	3,327,600	47,360,600				
12	240,000	160,000	200,000	$524,958	884,958	48,540,600	3,327,600	49,803,242		$524,958	$0.44	
13	260,000	160,000	250,000	1,399,259	1,809,259	51,868,200	3,327,600	51,321,583		1,924,217	1.60	
14	280,000	160,000	300,000	2,470,009	2,930,009	55,195,800	3,327,600	51,719,174		4,394,226	3.66	
15	300,000	160,000	350,000	3,540,759	4,050,759	58,523,400	3,327,600	50,996,015		7,934,985	6.62	
16	320,000	160,000	400,000	3,560,759	4,120,759	61,851,000	3,327,600	50,202,856		11,495,744	9.58	
17	340,000	160,000	450,000	3,580,759	4,190,759	65,178,600	3,327,600	49,339,697		15,076,503	12.57	
18	360,000	160,000	500,000	3,600,759	4,260,759	68,506,200	3,327,600	48,406,538		18,677,262	15.57	
19	380,000	160,000	550,000	3,620,759	4,330,759	71,833,800	3,327,600	47,403,379		22,298,021	18.59	
20	400,000	160,000	600,000	3,640,759	4,400,759	75,161,400	3,327,600	46,330,220		25,938,780	21.63	
21	420,000	160,000	650,000	3,660,759	4,470,759	78,489,000	3,327,600	45,187,061		29,599,539	24.68	
22	440,000	160,000	700,000	3,680,759	4,540,759	81,816,600	3,327,600	43,973,902		33,280,298	27.75	
23	460,000	160,000	750,000	3,700,759	4,610,759	85,144,200	3,327,600	42,690,743		36,981,057	30.83	
24	480,000	160,000	800,000	3,720,759	4,680,759	88,471,800	3,327,600	41,337,584		40,701,816	33.93	
25	500,000	160,000	850,000	3,740,759	4,750,759	91,799,400	3,327,600	39,914,425		44,442,575	37.05	
26	520,000	160,000	900,000	3,760,759	4,820,759	95,127,000	3,327,600	38,421,266		48,203,334	40.19	
27	540,000	160,000	950,000	3,780,759	4,890,759	98,454,600	3,327,600	36,858,107		51,984,093	43.34	
28	560,000	160,000	1,000,000	3,800,759	4,960,759	101,782,200	3,327,600	35,224,948		55,784,852	46.51	
29	580,000	160,000	1,050,000	3,820,759	5,030,759	105,109,800	3,327,600	33,521,789		59,605,611	49.69	
30	600,000	160,000	1,100,000	3,840,759	5,100,759	108,437,400	3,327,600	31,748,630		63,446,370	52.90	
31	620,000	160,000	1,150,000	3,860,759	5,170,759	111,765,000	3,327,600	29,905,471		67,307,129	56.12	
32	640,000	160,000	1,200,000	3,880,759	5,240,759	115,092,600	3,327,600	27,992,312		71,187,888	59.35	
33	660,000	160,000	1,250,000	3,900,759	5,310,759	118,420,200	3,327,600	26,009,153		75,088,647	62.60	
34	680,000	160,000	1,300,000	3,920,759	5,380,759	121,747,800	3,327,600	23,955,994		79,009,406	65.87	
35	700,000	160,000	1,350,000	3,940,759	5,450,759	125,075,400	3,327,600	21,832,835		82,950,165	69.16	
36	720,000	160,000	1,400,000	3,960,759	5,520,759	128,403,000	3,327,600	19,639,676		86,910,924	72.46	
37	740,000	160,000	1,450,000	3,980,759	5,590,759	131,730,600	3,327,600	17,376,517		90,891,683	75.78	
38	760,000	160,000	1,500,000	4,000,759	5,660,759	135,058,200	3,327,600	15,043,358		94,892,442	79.11	
39	780,000	160,000	1,550,000	4,020,759	5,730,759	138,385,800	3,327,600	12,640,199		98,913,201	82.47	

40	800,000	160,000	1,600,000	3,793,990	5,553,990	141,713,400	3,327,600	10,413,809	$246,769	102,707,191	85.63	$246,769
41	820,000	160,000	1,600,000		1,760,000	145,041,000	3,327,600	11,981,409	4,060,759	102,707,191	85.63	4,307,528
42	840,000	160,000	1,600,000		1,760,000	148,368,600	3,327,600	13,549,009	4,080,759	102,707,191	85.63	8,388,287
43	860,000	160,000	1,600,000		1,760,000	151,696,200	3,327,600	15,116,609	4,100,759	102,707,191	85.63	12,489,046
44	880,000	160,000	1,600,000		1,760,000	155,023,800	3,327,600	16,684,209	4,120,759	102,707,191	85.63	16,609,805
45	900,000	160,000	1,600,000		1,760,000	158,351,400	3,327,600	18,251,809	4,140,759	102,707,191	85.63	20,750,564
46	920,000	160,000	1,600,000		1,760,000	161,679,000	3,327,600	19,819,409	4,160,759	102,707,191	85.63	24,911,323
47	940,000	160,000	1,600,000		1,760,000	165,006,600	3,327,600	21,387,009	4,180,759	102,707,191	85.63	29,092,082
48	960,000	160,000	1,600,000		1,760,000	168,334,200	3,327,600	22,954,609	4,200,759	102,707,191	85.63	33,292,841
49	980,000	160,000	1,600,000		1,760,000	171,661,800	3,327,600	24,522,209	4,220,759	102,707,191	85.63	37,513,600
50	1,000,000	160,000	1,600,000		1,760,000	174,989,400	3,327,600	26,089,809	4,240,440	102,707,191	85.63	41,754,359
51	1,020,000	160,000	1,600,000		1,760,000	178,317,000	3,327,600	27,657,409	15,054,113	102,707,191	85.63	56,808,472
52	1,040,000	160,000	1,600,000		1,760,000	181,644,600	3,327,600	29,225,009	15,074,113	102,707,191	85.63	71,882,585
53	1,060,000	160,000	1,600,000		1,760,000	184,972,200	3,327,600	30,792,609	15,094,113	102,707,191	85.63	86,976,698
54	1,080,000	160,000	1,600,000		1,760,000	188,299,800	3,327,600	32,360,209	15,114,113	102,707,191	85.63	102,090,811
55	1,100,000	160,000	1,600,000		1,760,000	191,627,400	3,327,600	33,927,809	15,134,113	102,707,191	85.63	117,224,924
56	1,120,000	160,000	1,600,000		1,760,000	194,955,000	3,327,600	35,495,409	15,154,113	102,707,191	85.63	132,379,037
57	1,140,000	160,000	1,600,000		1,760,000	198,282,600	3,327,600	37,063,009	15,174,113	102,707,191	85.63	147,553,150
58	1,160,000	160,000	1,600,000		1,760,000	201,610,200	3,327,600	38,630,609	15,194,113	102,707,191	85.63	162,747,263
59	1,180,000	160,000	1,600,000		1,760,000	204,937,800	3,327,600	40,198,209	15,214,113	102,707,191	85.63	177,961,376
60	1,199,430	160,000	1,600,000		1,760,000	208,265,400		38,438,209	15,233,543	102,707,191	85.63	193,194,919
61	1,199,430	160,000	1,600,000		1,760,000	208,265,400		36,678,209	15,233,543	102,707,191	85.63	208,428,462
62	1,199,430	160,000	1,600,000		1,760,000	208,265,400		34,918,209	15,233,543	102,707,191	85.63	223,662,005
63	1,199,430	160,000	1,600,000		1,760,000	208,265,400		33,158,209	15,233,543	102,707,191	85.63	238,895,548
64	1,199,430	158,860	1,600,000		1,758,860	208,265,400		31,399,349	15,233,543	102,707,191	85.63	254,129,091
65	1,199,430	118,860	1,600,000		1,718,860	208,265,400		29,680,489	15,233,543	102,707,191	85.63	269,362,634
66	1,199,430	78,860	1,600,000		1,678,860	208,265,400		28,001,629	15,233,543	102,707,191	85.63	284,596,177
67	1,199,430	38,860	1,600,000		1,638,860	208,265,400		26,362,769	15,233,543	102,707,191	85.63	299,829,720
68	1,199,430		1,598,575		1,598,575	208,265,400		24,764,194	15,233,543	102,707,191	85.63	315,063,263
69	1,199,430		1,548,575		1,548,575	208,265,400		23,215,619	15,233,543	102,707,191	85.63	330,296,806
70	1,199,430		1,498,575		1,498,575	208,265,400		21,717,044	15,233,543	102,707,191	85.63	345,530,349
71	1,199,430		1,448,575		1,448,575	208,265,400		20,268,469	15,233,543	102,707,191	85.63	360,763,892
72	1,199,430		1,398,575		1,398,575	208,265,400		18,869,894	15,233,543	102,707,191	85.63	375,997,435
73	1,199,430		1,348,575		1,348,575	208,265,400		17,521,319	15,233,543	102,707,191	85.63	391,230,978
74	1,199,430		1,298,575		1,298,575	208,265,400		16,222,744	15,233,543	102,707,191	85.63	406,464,521
75	1,199,430		1,248,575		1,248,575	208,265,400		14,974,169	15,233,543	102,707,191	85.63	421,698,064
76	1,199,430		1,198,575		1,198,575	208,265,400		13,775,594	15,233,543	102,707,191	85.63	436,931,607
77	1,199,430		1,148,575		1,148,575	208,265,400		12,627,019	15,233,543	102,707,191	85.63	452,165,150
78	1,199,430		1,098,575		1,098,575	208,265,400		11,528,444	15,233,543	102,707,191	85.63	467,398,693
79	1,199,430		1,048,575		1,048,575	208,265,400		10,479,869	15,233,543	102,707,191	85.63	482,632,236
80	1,199,430		998,575		998,575	208,265,400		9,481,294	15,233,543	102,707,191	85.63	497,865,779
81	1,199,430		948,575		948,575	208,265,400		8,532,719	15,233,543	102,707,191	85.63	513,099,322
82	1,199,430		898,575		898,575	208,265,400		7,634,144	15,233,543	102,707,191	85.63	528,332,865
83	1,199,430		848,575		848,575	208,265,400		6,785,569	15,233,543	102,707,191	85.63	543,566,408
84	1,199,430		798,575		798,575	208,265,400		5,986,994	15,233,543	102,707,191	85.63	558,799,951
85	1,199,430		748,575		748,575	208,265,400		5,238,419	15,233,543	102,707,191	85.63	574,033,494
86	1,199,430		698,575		698,575	208,265,400		4,539,844	15,233,543	102,707,191	85.63	589,267,037
87	1,199,430		648,575		648,575	208,265,400		3,891,269	15,233,543	102,707,191	85.63	604,500,580
88	1,199,430		598,575		598,575	208,265,400		3,292,694	15,233,543	102,707,191	85.63	619,734,123
89	1,199,430		548,575		548,575	208,265,400		2,744,119	15,233,543	102,707,191	85.63	634,967,666
90	1,199,430		498,575		498,575	208,265,400		2,245,544	15,233,543	102,707,191	85.63	650,201,209

TABLE 6.—*Financial operation of irrigation development of Columbia Basin project*—Continued

Year after completion of dam	Acres settled	Repayments fifth to eighth year after settlement at $2 per acre	From lands ninth to fortieth year after settlement at $2.50 per acre	Repayment from power surplus at 2.25 mills per kilowatt-hour	Total repayment for year	Total cost of irrigation construction at beginning of year	Cost of irrigation construction during year	Investment remaining in irrigation development at end of year	Return from power surplus available for other purposes	Accumulated return from power surplus used for repayment of irrigation	Accumulated average return per acre from power surplus for 1,199,430 acres	Accumulated return from power surplus available for other purposes
91	1,199,430		$448,575		$448,575	$208,265,400		$1,796,969	$15,233,543	$102,707,191	$85.63	$665,434,752
92	1,199,430		398,575		398,575	208,265,400		1,398,394	15,233,543	102,707,191	85.63	680,668,295
93	1,199,430		348,575		348,575	208,265,400		1,049,819	15,233,543	102,707,191	85.63	695,901,838
94	1,199,430		298,575		298,575	208,265,400		751,244	15,233,543	102,707,191	85.63	711,135,381
95	1,199,430		248,575		248,575	208,265,400		502,669	15,233,543	102,707,191	85.63	726,368,924
96	1,199,430		198,575		198,575	208,265,400		304,094	15,233,543	102,707,191	85.63	741,602,467
97	1,199,430		148,575		148,575	208,265,400		155,519	15,233,543	102,707,191	85.63	756,836,010
98	1,199,430		98,575		98,575	208,265,400		56,944	15,233,543	102,707,191	85.63	772,069,553
99	1,199,430		48,575		48,575	208,265,400		8,369	15,233,543	102,707,191	85.63	787,303,096
100	1,199,430					208,265,400			15,233,543	102,707,191	85.63	802,536,639

TOTAL ANNUAL COST OF IRRIGATION

The total annual cost of irrigation benefits are estimated at $3.19 for the first four years if a depreciation reserve is provided. If no depreciation reserve is provided the cost is $2.59 per acre.

With $2 per acre for construction beginning the fifth year and continuing to and including the eighth year the total annual cost for irrigation excluding depreciation will be $4.59 per acre. Continuing thereafter for 32 years the annual cost will be $5.09 per acre.

When the construction payments from the land are added to the proportionate share of the estimated surplus power revenue the combined receipts from irrigation and power will not only liquidate the investment for each division or block of land irrigated within the 40-year period from the time each division is first irrigated but there will be sufficient surplus power revenue accruing during the 40 years subsequent to the completion of the Columbia River Dam to liquidate about one-half of the entire irrigation investment required for the ultimate project of 1,199,430 acres.

ABILITY OF LAND TO PAY FOR IRRIGATION BENEFITS

The lands to be irrigated on the project are well adapted to the production of alfalfa, sweet clover, potatoes, corn, and small grains. It is expected that the farm production will be largely fed to livestock and converted into beef, pork, and mutton. Dairying and poultry raising will also find a place in the farm program. With a proper rotation program and with a normal price relation between products of the farm marketed and those purchased it is expected that the land will be able to meet an annual charge of not to exceed $5.25 per acre for irrigation benefits.

PAYMENTS BY OTHER BENEFITED INTERESTS

While the foregoing charges are assumed to be borne entirely by the land and can only be realized by providing interest-free money for the entire irrigation investment and by assuming that about one-half of the irrigation investment is repaid from surplus power revenues, there are other interests than irrigation which will be greatly benefited by the proposed development and the charges accruing against the land might be reduced by applying an ad valorem tax to all property benefited within the irrigation district as provided by Washington State law.

POWER MARKET

Market area.—The market area in which the power from the proposed Columbia river development would have to be absorbed includes the area within a radius of approximately 300 miles of the dam site which includes all of the State of Washington, the northern part of Oregon, the northern part of Idaho, and the western part of Montana. Drawing No. 222–D–23 is a map of this area showing the principal power systems operating therein. The most important power market in this territory is the Puget Sound district in western

Washington which is the logical market for a large part of the Columbia River power. Following is a list of the principal power systems serving this territory:

Municipalities.—City of Seattle, city of Tacoma, city of Centralia.

Utility companies.—Puget Sound Power & Light Co., the Washington Water Power Co., Pacific Power & Light Co., Mountain States Power Co., Grays Harbor Railway & Light Co., Willapa Electric Co., Western Washington Electric Light & Power Co., Olympic Public Service Co., Washington Gas & Electric Co., the Montana Power Co.

Manufacturing companies.—Crown-Zellerback Corporation, Weyerhaeuser Timber Co.

The city of Seattle has been operating a municipal power system since 1905 and now supplies about 75 per cent of the consumers in the city. The city has 4 hydroelectric plants with a total installed capacity of 98,300 kilowatts and one steam-electric plant of 30,000 kilowatts capacity making a total combined capacity of 128,300 kilowatts. The systems of Seattle and Tacoma are interconnected through a 66,000-volt transmission line which has a capacity of approximately 15,000 kilowatts. Power from the city's hydroelectric development on the Skagit River is transmitted to the city over a 165,000-volt transmission line 100 miles in length.

The city of Tacoma has a municipal power system which has been in service since 1893 and this system now serves the entire city. The city's generating facilities consist of 3 hydroelectric plants having a combined installation of 116,000 kilowatts and 2 steam-electric plants having a combined capacity of 34,000 kilowatts, making a total capacity of 150,000 kilowatts. The city's system is interconnected with the city of Seattle and with the Puget Sound Power & Light Co. Power from the city's Lake Cushman hydroelectric development is transmitted at 110,000 volts over a line about 35 miles in length.

The city of Centralia completed the initial installation of 4,000 kilowatts in a hydroelectric power plant in 1930. The ultimate capacity of this development is 11,000 kilowatts. Power is transmitted to the city over a 66,000-volt transmission line 25 miles in length.

The Puget Sound Power & Light Co. which operates under the supervision of Stone & Webster (Inc.) serves the western part of Washington including the cities of Seattle, Bellingham, Everett, Olympia, Chehalis, Bremerton, and Wenatchee. The power system includes 15 hydroelectric plants having a combined installed capacity of 156,735 kilowatt and seven steam-electric plants having a combined installed capacity of 112,000 kilowatt making a total installed capacity of 268,735 kilowatt. This system is interconnected with the Washington Water Power Co. on the east and also with the city of Tacoma, the Washington Pulp & Paper Corporation, the Northwestern Electric Co., Western Canada Power Co., Great Northern Railway, Weyerhaeuser Timber Co., and with the United States navy yard at Bremerton. In 1931 the initial installation, consisting of two units of 15,000-kilowatt capacity each, in the new hydroelectric development at Rock Island on the Columbia River was placed in service. This development is planned for an ultimate

installation of 150,000 kilowatts. Power is transmitted from this plant to the Puget Sound district over 110,000-volt lines.

The Washington Water Power Co. is controlled by the American Power & Light Co. which in turn belongs to the Electric Bond & Share Co. group of properties. This company operates in eastern Washington and northern Idaho and has 13 hydroelectric power plants with a combined generating capacity of 205,584 kilowatts. The company is interconnected with the Pacific Power & Light Co., the Montana Power Co., Puget Sound Power & Light Co., Mountain States Power, Stevens County Power & Light Co. and the Chicago, Milwaukee & St. Paul Railroad. The company has a large hydroelectric plant at Chelan Falls where two units of 24,000-kilowatt capacity each are now installed and where an additional 72,000 kilowatts can be developed by the installation of additional units as may be required to meet the growth in load.

The Pacific Power & Light Co. operates in southern Washington, northern Oregon and northern Idaho. It is controlled by the American Power & Light Co. and belongs to the Electric Bond & Share group of properties. The system comprises five hydroelectric plants having a combined installed capacity of 13,500 kilowatts and two steam-electric plants having a combined capacity of 3,000 kilowatts, making a total capacity of 16,500 kilowatts. The system is interconnected with the Washington Water Power Co. and with the Northwestern Electric Co.

The Mountain States Power Co. operates in northwestern Washington, western Oregon, and northern Idaho. It is controlled by the Standard Gas & Electric Co. which in turn belongs to the H. M. Byllesby & Co. group of properties. The company has a small power plant at Sandpoint, Idaho, with an installed capacity of 500 kilowatts and obtains most of the energy required on this system from the Washington Water Power Co. over a 66,000-volt interconnection.

The Federal Light & Traction Co., a subsidiary of the Cities Service Co. owns and operates a number of small power systems along the west coast of Washington. These properties include the Grays Harbor Railway & Light Co., the Willapa Electric Co., the Western Washington Electric Light & Power Co., and the Olympic Public Service Co. They have a total generating capacity of 13,186 kilowatts of which 12,900 kilowatts is steam-electric and 286 kilowatts is Diesel-electric. Additional power is obtained from lumber mills in the immediate vicinity and from the Puget Sound Power & Light Co.

The Washington Gas & Electric Co. operates in the vicinity of Longview, Wash. The company is controlled by the North American Gas & Electric Co. It has a steam-electric plant at Longview having a capacity of 24,000 kilowatts.

The Montana Power Co. is controlled by the American Power & Light Co. and belongs to the Electric Bond & Share group of properties. The western part of the Montana Power Co. system in the extreme western part of the State of Montana is in the territory considered as the market area for the Columbia River power. The Thompson Falls hydroelectric plant, which is located in this territory, has an installed capacity of 35,000 kilowatts. This plant is interconnected with the Washington Water Power Co. on the west and with the main system of the Montana Power Co. on the east through the Chicago, Milwaukee & St. Paul Railway Co.'s lines.

The Crown-Zellerbach Corporation which is engaged in the paper industry has two hydroelectric plants having a combined capacity of 25,000 kilowatts and six steam-electric plants having a combined capacity of 30,150 kilowatts, making a total installed capacity of 55,150 kilowatts. This company has interconnections with the Puget Sound Power & Light Co. The Washington Pump & Paper Corporation is the largest subsidiary of the Crown-Zellerbach group in Washington.

The Weyerhaeuser Timber Co. is engaged in the lumber industry in the Northwest. It has three important steam-electric generating stations having a total installed capacity of 29,000 kilowatts.

Future increase in power usage.—During the 10-year period ending with 1930 the requirements for power, as shown in Table No. 7, in the territory within a radius of 300 miles of the proposed Columbia River development have been increasing at an average rate of 9.5 per cent, per year, compounded annually. The population of this territory is approximately 3,000,000 or about the same as the northern portion of California, and the energy generated during 1930 was approximately 85 per cent of the amount required to supply the northern California market. A study was made of the northern California power market in 1928 by Mr. Lester S. Ready, consulting engineer of San Francisco, Calif., in connection with the proposed Kennett Reservoir development on the Sacramento River, a report on which was published as Bulletin No. 20 of department of public works of the State of California. In that report it was estimated that the future growth in load in northern California would be at a reducing percentage, ranging from approximately 7 per cent in 1928, to as low as 4 per cent about 1950.

TABLE No. 7.—*Data for power market, which includes the area within a 300-mile radius of the proposed dam site, and all of Oregon*

Year	Power output in millions of kilowatt-hours			Average load in kilowatts	Peak load in kilowatts	Installed capacity in kilowatts
	Market area excluding Oregon	Total for Oregon	Total for market area			
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1917	964	325	1,289	147,146	294,292	364,987
1920	1,309	476	1,785	203,767	407,534	432,145
1921	1,175	469	1,644	187,671	375,342	437,645
1922	1,294	513	1,807	206,279	412,558	486,245
1923	1,548	594	2,142	244,520	489,040	517,660
1924	1,633	678	2,311	263,813	527,626	535,458
1925	1,701	730	2,431	277,511	555,022	643,868
1926	2,020	831	2,851	325,457	650,914	717,022
1927	2,278	845	3,123	356,507	713,014	768,082
1928	2,569	1,041	3,610	412,100	824,200	829,215
1929	2,705	1,161	3,866	441,324	882,648	921,025
1930	2,811	1,219	4,030	460,046	920,092	974,860

Figures in column (2) were compiled from reports of the Puget Sound Power & Light Co., city of Seattle, city of Tacoma, Wash. Pulp & Paper Corporation, Gray's Harbor Railway & Light Co., Pacific Power & Light Co., the Thompson Falls plant of the Montana Power Co., the Washington Water Power Co., which includes the Lewiston and Grangeville plants in northern Idaho, all associated companies and their predecessor companies.

Figures in column (3) were taken directly from the reports of the United States Geological Survey.

Figures in column (4) are the total of those in columns (2) and (3).

Figures in column (5) were derived from those in column (4).

Figures in column (6) were derived from those in column (5) by assuming a 50 per cent load factor.

Figures in column (7) were compiled from reports of the companies mentioned in note (2) together with data obtained from reports of the United States Geological Survey for the State of Oregon.

The Seattle district engineer, Corps of Engineers, U. S. Army, made a very comprehensive investigation of the power market situation in the Northwest and in a report on the Columbia River dated July 31, 1931, estimated that the future increase in power requirements would be at a gradually reduced rate of increase starting with a rate of increase of 9.5 per cent in 1930, decreasing to 4.75 per cent in 1960 and finally reaching zero in 1990. This estimate of load growth is shown graphically by curves A on drawing No. 222–D–6.

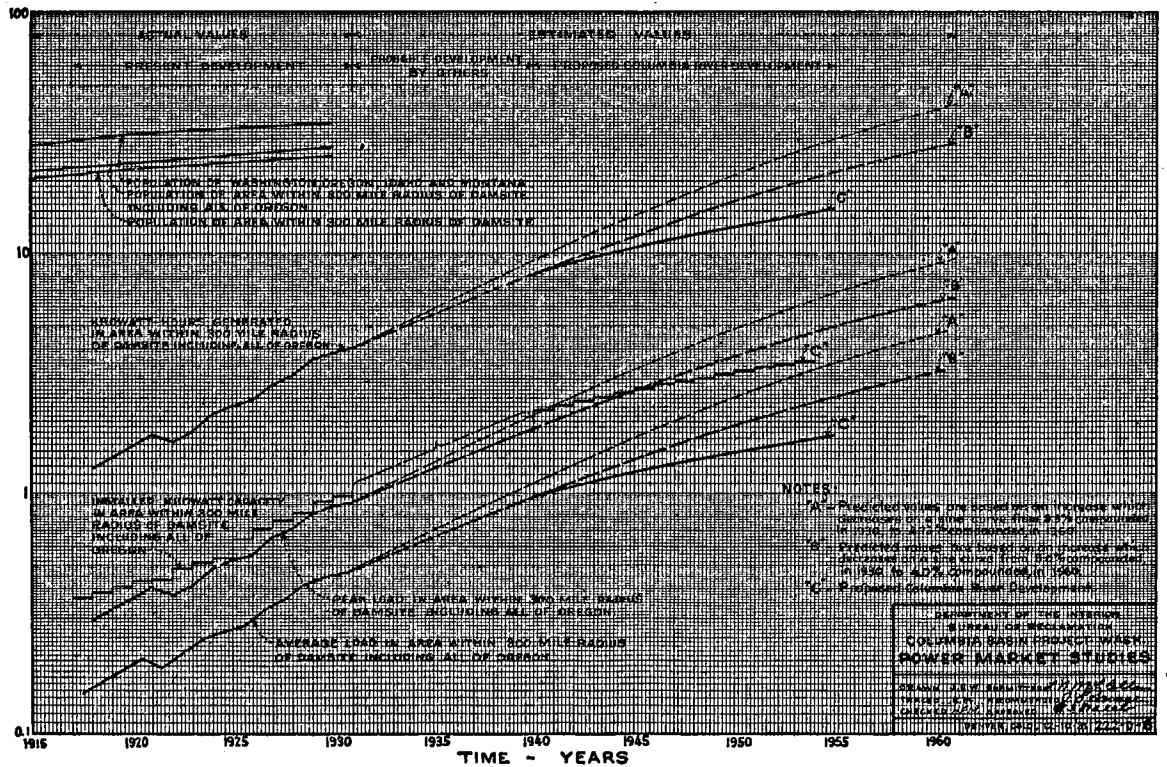
For the purposes of this study a somewhat more conservative assumption has been used in regard to future increase in power requirements. A gradually decreasing rate of increase has been assumed beginning with 8 per cent in 1930 and decreasing to 4 per cent in 1960. This is shown graphically by curves B on drawing No. 222–D–6.

Absorption of Columbia River power.—The installed generator capacity in the territory in which the power from the proposed Columbia River development would have to be absorbed now amounts to a little over one million kilowatts and if the load continues to increase in the next decade as it has in the past, but at a gradually reduced rate of increase as suggested above the installed capacity will have to be doubled by 1940 in order to supply the demand. Practically all of the major hydroelectric developments on which construction has been started by the various power companies and municipalities will have been absorbed by 1940, which is the earliest date that power from the Columbia River development could be made available.

Assuming that the power load continues to increase after 1940 in accordance with curves B on drawing No. 222–D–6, there would be required a total of 5,000,000 kilowatts of generating capacity by 1955. The additional generating capacity that would have to be provided during the 15-year period 1940 to 1955 would amount to about 3,000,000 kilowatts, whereas the proposed installation at the Columbia River power plant is 1,500,000 kilowatts. In other words the proposed installation of 1,500,000 kilowatts would take care of approximately half of the expected increase in power requirements during a 15-year absorption period. The other half of the expected increase would have to be supplied by other hydro or steam developments.

The total amount of energy generated in the territory in which the output of the proposed power plant would have to be utilized amounted to 4,030,000,000 kilowatt-hours in 1930. If the energy requirements continue to increase in the future as they have in the past 10 years, but at a gradually reducing rate of increase, as indicated by curves B on drawing No. 222–D–6, the total amount of energy generated will be approximately 8,000,000,000 kilowatt-hours in 1940, and this will have increased to over 20,000,000,000 kilowatt-hours in 1955. The annual energy requirements will have increased 12,000,000,000 kilowatt-hours in the 15-year period from 1940 to 1955 during which it is assumed that the energy output of the Columbia River power plant will be absorbed. The total amount of firm energy which this plant will make available will be 7,000,000,000 kilowatt-hours per year, which amount will be sufficient to meet less than half the expected increase in the 15-year absorption period. The remainder would have to be supplied from other sources.

222-D-6—Population in hundreds of thousands; power output in billions of kilowatt-hours; load and capacity in millions of kilowatts



With proper cooperation on the part of the various power companies and municipalities which will have to absorb the power output of the proposed Columbia River development no serious difficulty should arise in connection with the absorption of this large block of power within 15 years after the initial installation is completed and it might be possible that the full output could be absorbed in a shorter time. The economic feasibility of the project is dependent to a very large degree on the rapidity of absorption of the power, particularly during the early years of operation when the revenues from power will be insufficient to meet the annual expense and deficits will be inevitable.

COMPETITIVE POWER

The economic limitations of transmission of electric power over high voltage transmission lines make it necessary that the power to be developed at the proposed Columbia River dam be utilized within a radius of approximately 300 miles. Under certain special conditions surplus power available at the Columbia River dam might be used in lieu of power from other sources and thereby release the latter for use elsewhere in more distant markets, but such an arrangement would be used only as a means of utilizing surplus energy and would have little effect on the price of firm power.

The Pacific Northwest is estimated to have 38 per cent of the total potential water power in the United States and quite naturally the present power requirements are supplied largely from hydro sources. The installed generator capacity in this territory is now a little over 1,000,000 kilowatts, of which about 28 per cent is in steam plants and the remainder or about 72 per cent in hydro plants. Previous to 1929 the steam plants produced about 5 per cent of the total energy while in 1929, due to low stream flow, the output of the steam plants increased to 14.5 per cent and in 1930 it was about 10.4 per cent of the total power generated.

It is probable that a large part of the additional power installations in the Northwest during the next decade will be hydro rather than steam as all of the large power companies and the municipalities which have power systems have hydro developments planned and partially developed. The Puget Sound Power & Light Co. has the Rock Island development on the Columbia River where an additional 120,000 kilowatts can be installed; the capacity of the Lake Chelan development of the Washington Water Power Co. can be increased by 70,000 kilowatts by the installation of additional generating units; the Inland Power & Light Co. has a development on the Lewis River where 160,000 kilowatts will be developed ultimately. The city of Seattle has its Skagit River development underway where some 780,000 kilowatts can be developed ultimately, which is expected to meet the needs of the city during the next 15 years. The city of Tacoma has its Cushman development, the capacity of which can be increased by 100,000 kilowatts. The proposed hydroelectric development which the Montana Power Co. has planned at the outlet of Flathead Lake will add about 100,000 kilowatts to the generating facilities of that system.

Naturally the smaller hydro developments located close to the load centers and which were easy and cheap to construct were undertaken

first and up to the present time the tremendous potential resources of the larger rivers have offered blocks of power so large compared to the needs of the systems as to be unfeasible economically. The rapid growth of power demands has now reached a point where the larger developments are economically feasible with the result that such projects as the Rock Island on the Columbia River, the Ariel on the Lewis River, and Diablo on the Skagit River are being undertaken.

By the time the initial installation at the proposed Columbia River dam is placed in service most of the hydro developments which are now being constructed by the various power companies and municipalities will be completed and the Columbia River power will have to compete in price with power from additional developments which will be more costly than those now under construction and which are located farther from the market and consequently will involve more costly transmission facilities and also with power produced in large modern steam generating stations located near the load centers and using the cheapest fuel obtainable.

Under present conditions in the Northwest hydro power can be delivered at load centers at somewhat less cost than steam power as evidenced by the fact that the new developments planned for the immediate future are all hydro, but as the distances that the hydro power must be transmitted become greater and as the cost of construction of the hydro plants becomes greater due to the more difficult and expensive projects being left for later development, coupled with the downward trend of steam plant costs and the steady improvement in steam plant efficiencies, the present narrow margin between the cost of hydro and steam power is constantly becoming smaller and it seems probable that by the time power from the proposed development on the Columbia River at the head of Grand Coulee becomes available the cost of steam power rather than the cost of hydro power from other sources will determine the value of the Columbia River power.

Value of power as determined by the cost of steam-electric power.—During recent years there has been a very marked improvement in the efficiency of steam generating stations and it is to be expected that this trend will continue in the future. Large modern steam plants are now capable of producing 480 kilowatt-hours per barrel of fuel oil when operating at 60 per cent load factor which corresponds to a thermal efficiency of about 13,000 British thermal units per kilowatt-hour. It seems probable that the thermal efficiency may be improved in the near future so that a kilowatt-hour will require not more than 12,000 British thermal units.

There is an ample supply of coal available in the Northwest and several of the smaller steam plants are operating on refuse from the lumber industry. The available supply of natural gas is too limited to make this fuel a factor in determining the cost of steam power. The Shuffleton steam plant of the Puget Sound Power & Light Co. located on Lake Washington, which is the largest and most modern plant in the Northwest, and which is designed so that it can be readily converted to utilize hogged fuel (lumber refuse) or pulverized coal, is now burning fuel oil which, under present conditions, is the cheapest fuel obtainable in sufficient quantities for large central station use.

The price of fuel is the most important single factor affecting the cost of steam power and the question of future price of fuel oil is impossible of determination for any period of time. At present the average price of fuel oil in southern California fields is 70 to 80 cents per barrel. The cost of transporting fuel oil in tankers from southern California to Puget Sound ports amounts to about 25 cents per barrel and the cost delivered is about $1 per barrel or slightly less. This is less than the present cost of the equivalent quantity of coal.

The California conservation law which went into effect during the summer of 1929 requires the beneficial use of natural gas as a condition to the production of oil and this has resulted in marked reductions in the price of gas, in some instances down to the equivalent of oil at about 50 cents per barrel. Naturally this low price for natural gas has had considerable effect on the price of fuel oil. It seems fair to assume that the condition of over production and consequent low price of fuel oil will prove to be temporary and it is the general consensus of opinion that over a long period of time the price of fuel oil will increase rather than decrease. The depletion of nearby oil fields and natural gas supplies, improvements in the processes for obtaining gasoline from fuel oil which will have a tendency to decrease the fuel oil residue, together with the general governmental policy of conservation and restriction of production, will all tend toward this end.

Considering the present price of fuel oil and that as noted above, these prices are more likely to increase rather than decrease; a price of $1 per barrel delivered at Puget Sound ports has been used as a basis for determining the cost of steam power.

The largest and most efficient steam power plant on the west coast is the Long Beach No. 3 plant of the Southern California Edison Co., which is designed for an ultimate installation of four units of 100,000 kilowatts capacity each. This plant is equipped for using either natural gas or fuel oil and is arranged so that coal-burning equipment can be installed later if it should develop that such fuel is more economical. The steam pressure is 400 pounds and the temperature of the steam is 700° F. At 100 per cent load factor this plant produces a little better than 490 kilowatt-hours net per barrel of fuel-oil, corresponding to a fuel economy of 12,674 British thermal units per kilowatt-hour. The cost of this power plant will be $77.50 per kilowatt of installed capacity when the ultimate installation of four units is completed. The Los Angeles Gas & Electric Corporation has a smaller steam plant located at Seal Beach near Los Angeles which is reported to have cost $78.20 per kilowatt of installed capacity. The Shuffleton steam plant recently constructed by the Puget Sound Power & Light Co. is reported to have cost $105 per horsepower or $140 per kilowatt of installed capacity.

For the purposes of this study the following assumptions have been used to determine the cost of competitive steam power based on the cost and performance of the Long Beach No. 3 plant of the Southern California Edison Co.:

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Considering the present price of fuel oil and that as noted above, these prices are more likely to increase rather than decrease; a price of $1 per barrel delivered at Puget Sound ports has been used as a basis for determining the cost of steam power.

The largest and most efficient steam power plant on the west coast is the Long Beach No. 3 plant of the Southern California Edison Co., which is designed for an ultimate installation of four units of 100,000 kilowatts capacity each. This plant is equipped for using either natural gas or fuel oil and is arranged so that coal-burning equipment can be installed later if it should develop that such fuel is more economical. The steam pressure is 400 pounds and the temperature of the steam is 700° F. At 100 per cent load factor this plant produces a little better than 490 kilowatt-hours net per barrel of fuel-oil, corresponding to a fuel economy of 12,674 British thermal units per kilowatt-hour. The cost of this power plant will be $77.50 per kilowatt of installed capacity when the ultimate installation of four units is completed. The Los Angeles Gas & Electric Corporation has a smaller steam plant located at Seal Beach near Los Angeles which is reported to have cost $78.20 per kilowatt of installed capacity. The Shuffleton steam plant recently constructed by the Puget Sound Power & Light Co. is reported to have cost $105 per horsepower or $140 per kilowatt of installed capacity.

For the purposes of this study the following assumptions have been used to determine the cost of competitive steam power based on the cost and performance of the Long Beach No. 3 plant of the Southern California Edison Co.:

STEAM GENERATING STATION DATA

Capital cost, $77.50 per kilowatt of installed capacity.

Fuel consumption, 0.002 barrel per kilowatt-hour generated plus 0.55 barrel per kilowatt of installed capacity per year.

Operation and maintenance, $2.25 per kilowatt of required capacity.

Required capacity=peak load.

Installed capacity=110 per cent of required capacity.

	Public development	Private development
	Per cent	*Per cent*
Rate of return on investment	0	7.0
Rate of interest	4.75	0
Amortization	.88	0
Depreciation	2.25	2.25
Taxes	0	1.50
General expense (per cent of total cost other than fuel and taxes)	3.0	3.0

Tables 8 and 9 show the cost of steam generated energy under the above assumptions for public and privately owned steam plants, with the price of fuel oil varying from 75 cents to $1.50 per barrel delivered and for various load factors from 40 to 80 per cent.

Drawing No. 222–D–7 shows graphically the cost of steam generated energy for both public and privately owned and operated steam plants with various prices of fuel oil and various load factors.

TABLE No. 8.—*Estimated cost of steam-generated energy, public development*

	Cost of fuel oil per barrel			
	$0.75	$1.00	$1.25	$1.50
Load factor, 40 per cent; kilowatt-hours generated per year per kilowatt capacity, 3,504; barrels of fuel oil per year per kilowatt capacity, 7.613; kilowatt-hours per barrel of fuel oil, 460.				
Interest, depreciation, amortization, and operation and maintenance	$8.968	$8.968	$8.968	$8.968
General expenses, 3 per cent of above	.269	.269	.269	.269
Cost of fuel oil per year per kilowatt capacity	5.710	7.613	9.516	11.419
Total annual cost per kilowatt required	14.947	16.850	18.753	20.656
Cost per kilowatt-hour—mills	4.266	4.809	5.352	5.895
Load factor, 50 per cent; kilowatt-hours generated per year per kilowatt capacity, 4,380; barrels of fuel oil per year per kilowatt capacity, 9.365; kilowatt-hours per barrel of fuel oil, 468.				
Interest, depreciation, amortization, and operation and maintenance	8.968	8.968	8.968	8.968
General expenses, 3 per cent of above	.269	.269	.269	.269
Cost of fuel oil per year per kilowatt capacity	7.024	9.365	11.706	14.047
Total annual cost per kilowatt required	16.261	18.602	20.943	23.284
Cost per kilowatt-hour—mills	3.712	4.247	4.781	5.316
Load factor, 60 per cent; kilowatt-hours generated per year per kilowatt capacity, 5,256; barrels of fuel oil per year per kilowatt capacity, 11.117; kilowatt-hours per barrel of fuel oil, 473.				
Interest, depreciation, amortization, and operation and maintenance	8.968	8.968	8.968	8.968
General expenses, 3 per cent of above	.269	.269	.269	.269
Cost of fuel oil per year per kilowatt capacity	8.338	11.117	13.896	16.675
Total annual cost per kilowatt required	17.575	20.354	23.133	25.912
Cost per kilowatt-hour—mills	3.344	3.872	4.401	4.930
Load factor, 70 per cent; kilowatt-hours generated per year per kilowatt capacity, 6,132; barrels of fuel oil per year per kilowatt capacity, 12.869; kilowatt-hours per barrel of fuel oil, 476.				
Interest, depreciation, amortization, and operation and maintenance	8.968	8.968	8.968	8.968
General expenses, 3 per cent of above	.269	.269	.269	.269
Cost of fuel oil per year per kilowatt capacity	9.652	12.869	16.086	19.303
Total annual cost per kilowatt required	18.889	22.106	25.323	28.540
Cost per kilowatt-hour—mills	3.080	3.605	4.130	4.654

TABLE NO. 8.—*Estimated cost of steam-generated energy, public development*—Continued

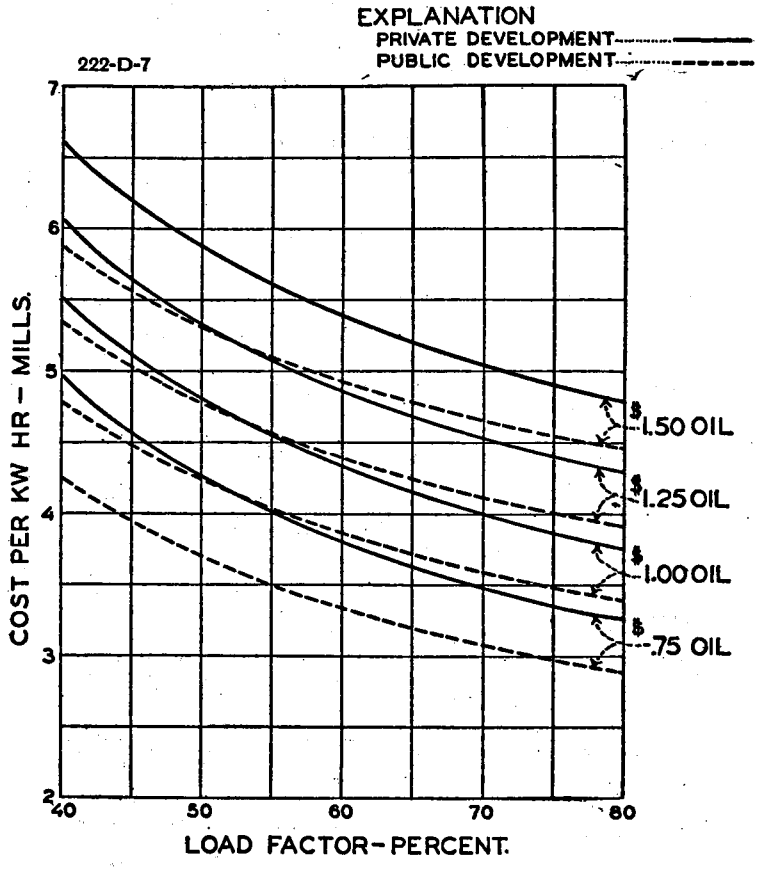
	Cost of fuel oil per barrel			
	$0.75	$1.00	$1.25	$1.50
Load factor, 80 per cent; kilowatt-hours generated per year per kilowatt capacity, 7,008; barrels of fuel oil per year per kilowatt capacity, 14.621; kilowatt-hours per barrel of fuel oil, 479.				
Interest, depreciation, amortization, and operation and maintenance	$8.968	$8.968	$8.968	$8.968
General expenses, 3 per cent of above	.269	.269	.269	.269
Cost of fuel oil per year per kilowatt capacity	10.966	14.621	18.276	21.931
Total annual cost per kilowatt required	20.203	23.858	27.513	31.168
Cost per kilowatt-hour—mills	2.883	3.404	3.926	4.447

TABLE NO. 9.—*Estimated cost of steam generated energy, private development*

	Cost of fuel oil per barrel			
	$0.75	$1.00	$1.25	$1.50
Load factor, 40 per cent; kilowatt hours generated per year per kilowatt capacity, 3,504; barrels of fuel oil per year per kilowatt capacity, 7.613; kilowatt hours per barrel of fuel oil, 460.				
Depreciation, return on investment and operation and maintenance	$10.136	$10.136	$10.136	$10.136
General expenses, 3 per cent above	.304	.304	.304	.304
Taxes	1.279	1.279	1.279	1.279
Cost of fuel oil per year per kilowatt capacity	5.710	7.613	9.516	11.419
Total annual cost per kilowatt required	17,429	19,332	21,235	23,138
Cost per kilowatt hour mills	4.974	5.517	6.060	6.603
Load factor, 50 per cent; kilowatt hours generated per year per kilowatt capacity, 4,380; barrels of fuel oil per year per kilowatt capacity, 9.365; kilowatt hours per barrel of fuel oil, 468.				
Depreciation, return on investment and operation and maintenance	10.136	10.136	10.136	10.136
General expenses, 3 per cent of above	.304	.304	.304	.304
Taxes	1.279	1.279	1.279	1.279
Cost of fuel oil per year per kilowatt capacity	7.024	9.365	11.706	14.047
Total annual cost per kilowatt required	18.743	21.084	23.425	25.766
Cost per kilowatt hour, mills	4.279	4.814	5.348	5.883
Load factor, 60 per cent; kilowatt hours generated per year per kilowatt capacity, 5,256; barrels of fuel oil per year per kilowatt capacity, 11.117; kilowatt hours per barrel of fuel oil, 473.				
Depreciation, return on investment, and operation and maintenance	10.136	10.136	10.136	10.136
General expenses, 3 per cent of above	.304	.304	.304	.304
Taxes	1.279	1.279	1.279	1.279
Cost of fuel oil per year per kilowatt capacity	8.338	11.117	13.895	16.675
Total annual cost per kilowatt required	20.057	22.836	25.615	28.394
Cost per kilowatt hour, mills	3.816	4.345	4.873	5.402
Load factor, 70 per cent; kilowatt hours generated per year per kilowatt capacity, 6,132; barrels of fuel oil per year per kilowatt capacity, 12.869; kilowatt hours per barrel of fuel oil, 476.				
Depreciation, return on investment, and operation and maintenance	10.136	10.136	10.136	10.136
General expenses, 3 per cent of above	.304	.304	.304	.304
Taxes	1.279	1.279	1.279	1.279
Cost of fuel oil per year per kilowatt capacity	9.652	12.869	16.086	19.303
Total annual cost per kilowatt required	21.371	24.588	27.805	31.022
Cost per kilowatt hour, mills	3.485	4.010	4.534	5.059
Load factor, 80 per cent; kilowatt hours generated per year per kilowatt capacity, 7,008; barrels of fuel oil per year per kilowatt capacity, 14.621; kilowatt hours per barrel of fuel oil, 479.				
Depreciation, return on investment, and operation and maintenance	10.136	10.136	10.136	10.136
General expenses, 3 per cent of above	.304	.304	.304	.304
Taxes	1.279	1.279	1.279	1.279
Cost of fuel oil per year per kilowatt capacity	10.966	14.621	18.276	21.931
Total annual cost per kilowatt required	22.865	26.340	29.995	33.650
Cost per kilowatt hour, mills	3.263	3.758	4.280	4.802

TRANSMISSION OF COLUMBIA RIVER POWER

Cost of transmission facilities.—At present 220,000 volts is the practical limit for high-voltage, high-power, long-distance transmission. Higher voltages are being investigated but considering the greater first cost of transmission lines designed and built for such higher voltages, it seems doubtful if any marked reduction in the cost of transmitting energy would be affected and at the present



TOTAL COST OF GENERATING STEAM POWER FOR VARYING LOAD FACTORS AT DIFFERENT PRICE FOR FUEL OIL.

state of the art it would not be conservative to assume that power from the proposed Columbia River development would be transmitted at a voltage of more than 220,000.

The area in the vicinity of Puget Sound offers the largest market for Columbia River power within economic transmission distance

and it is assumed that a large part of the power will be utilized in that territory ultimately. The distance that the power would have to be transmitted to reach this market would be approximately 170 miles.

As a basis for determining the cost of transmitting electrical energy to this market, it is assumed that four 220,000-volt circuits would be provided, each capable of delivering 127,000 kilowatts under normal operating conditions with a reasonable factor of safety against instability at times of system disturbances. Each circuit would be capable of carrying up to 146,000 kilowatts under emergency conditions when one of the other circuits is out of service. Synchronous condensers would be provided as part of the terminal substation equipment in the ratio of 0.59 kilovolt-ampere of condenser capacity per kilowatt of delivered power, for regulation of power-factor and voltage.

The cost of the transmission lines including terminal substations and right of way is estimated as follows:

340 miles double circuit 220 kilovolt line	$8,950,000
Terminal substations, including synchronous condenser equipment	5,458,000
Right of way	1,510,000
Total	15,918,000

Estimated annual cost of transmission lines including terminal substations is as follows:

	Public development	Private development
Fixed charges:		
Interest, 4.75 per cent	$756,000	
Return on investment, 7 per cent		$1,114,000
Amortization, 0.88 per cent	140,000	
Taxes, 1.5 per cent		239,000
Depreciation, exclusive of right-of-way, 2.25 per cent	324,000	324,000
Operation and maintenance:		
Line, $125 per circuit mile	85,000	85,000
Terminal substation, 2 per cent of cost	109,000	109,000
Subtotal	1,414,000	1,871,000
General expense, 2 per cent of above	28,000	37,000
Total annual cost	1,442,000	1,908,000

In order to provide reliable and satisfactory service over long distance power transmission circuits, it is generally considered necessary to provide sufficient steam stand-by generating capacity at the terminal end which, together with the overload capacity of the circuits remaining in service, will carry the full load with one of the circuits out of service. On this basis there would be required 70,000 kilowatts of steam stand-by capacity to supplement the delivery of power over the four 220,000-volt circuits contemplated for delivering power to the Puget Sound area at times when one of the four circuits is out of service.

The assumptions used and the estimated annual cost of providing steam stand-by are shown in Table 10 and the annual cost of steam stand-by in dollars per kilowatt of capacity for various prices of fuel-oil and for both public and private developments are shown graphically on drawing No. 222–D–8.

Cost of transmitting energy.—The total cost in mills per kilowatt-hour for transmitting energy from the Columbia River power plant to the load center for various load factors and prices of fuel oil and for both public and private developments are shown by Tables Nos. 11, 12, and 13 and by graphs on drawings Nos. 222–D–9 and 222–D–10.

These costs were determined by the following formulas:

$$C=\frac{T}{1000K}$$

and

$$C_s=\frac{T+S}{1000K}$$

Where—

C=cost in mills per kilowatt-hour for transmitting energy from the Columbia River power plant to the load center, without steam stand-by.

$C_s=C$, except with steam stand-by.

T=annual cost, in dollars, of transmission from the Columbia River power plant to the load center (for the various load factors and for public and private developments as shown in item "b" of Table No. 14).

S=annual cost, in dollars, of steam stand-by (for the corresponding load factors, for public and private developments, and for the various fuel costs, as shown in item "d" of Table No. 14).

K=total energy generated at the Columbia River power plant in millions of kilowatt-hours (for the corresponding load factors as shown in Table No. 14).

TABLE No. 10—

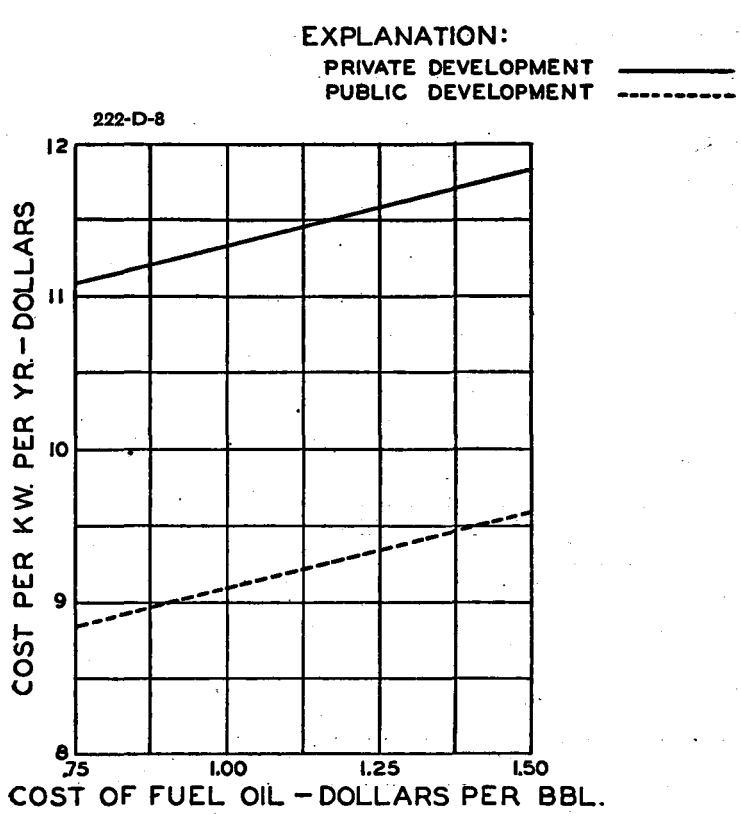
ESTIMATED YEARLY COST OF STEAM STAND-BY, PUBLIC AND PRIVATE DEVELOPMENTS

Assumptions:

Capital cost per kilowatt of installed capacity	$77.50
Depreciation (per cent)	2.25
Operation and maintenance per kilowatt	$1.75
Fuel oil, barrels per kilowatt	1.00
General expenses, 3 per cent of costs other than oil and taxes	3.00
Return on investment for private development (per cent)	7.00
Taxes on investment for private development (per cent)	1.50
Rate of interest for public development (per cent)	4.75
Amortization for public development (40-year sinking fund at 4¾ per cent)	0.88

ANNUAL COST PER KILOWATT

	Cost of fuel oil per barrel			
	$0.75	$1	$1.25	$1.50
Private development:				
Depreciation, return on investment and operation and maintenance	$8.919	$8.919	$8.919	$8.919
General expenses	.267	.267	.267	.267
Fuel oil	.75	1.00	1.25	1.50
Taxes	1.162	1.162	1.162	1.162
Cost per kilowatt per annum (dollars)	11.098	11.348	11.598	11.848
Public development:				
Interest, depreciation, amortization and operation and maintenance	7.857	7.857	7.857	7.857
General expenses	.235	.235	.235	.235
Fuel oil	.75	1.00	1.25	1.50
Cost per kilowatt per annum (dollars)	8.842	9.092	9.342	9.592



ANNUAL COST OF STEAM STANDBY PER KILOWATT OF CAPACITY.

TABLE No. 11.—*Cost of transmitting energy to load center, public and private developments, without steam standby, Columbia Basin project*

	Public development	Private development		Public development	Private development
Load factor, 40 per cent:			Load factor, 70 per cent:		
T	1,442,800	1,908,800	T	1,442,800	1,908,800
K	1,967	1,967	K	3,442	3,442
C	0.734	0.970	C	0.419	0.555
Load factor, 50 per cent:			Load factor, 80 per cent:		
T	1,442,800	1,908,800	T	1,442,800	1,908,800
K	2,459	2,459	K	3,934	3,934
C	0.587	0.776	C	0.367	0.485
Load factor, 60 per cent:					
T	1,442,800	1,908,800			
K	2,950	2,950			
C	0.489	0.647			

T=annual cost, in dollars, of transmission from Columbia River to load center.
K=total energy generated at Columbia River in millions of kilowatt-hours.
C=cost in mills per kilowatt-hour for transmitting energy from Columbia River to load center, without steam standby.

TABLE No. 12.—*Cost of transmitting energy to load center, public development, with steam standby, Columbia Basin project*

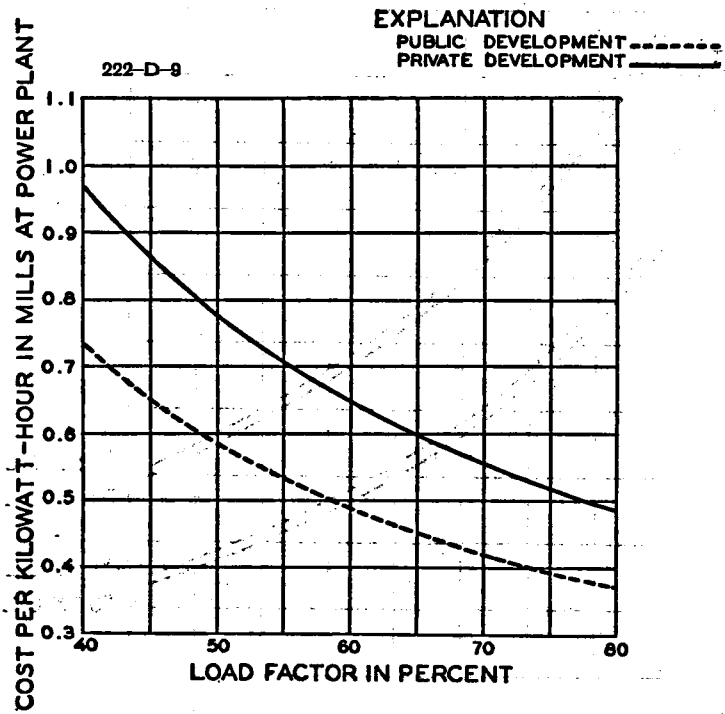
Cost of fuel oil per barrel	$0.75	$1.00	$1.25	$1.50
Load factor, 40 per cent:				
T	1,442,800	1,442,800	1,442,800	1,442,800
S	618,900	636,400	653,900	671,400
T+S	2,061,700	2,079,200	2,096,700	2,114,200
K (millions of kilowatt-hours)	1,967	1,967	1,967	1,967
Cs	1.048	1.057	1.066	1.075
Load factor, 50 per cent:				
T	1,442,800	1,442,800	1,442,800	1,442,800
S	618,900	636,400	653,900	671,400
T+S	2,061,700	2,079,200	2,096,700	2,114,200
K (millions of kilowatt-hours)	2,459	2,459	2,459	2,459
Cs	0.838	0.846	0.853	0.860
Load factor, 60 per cent:				
T	1,442,800	1,442,800	1,442,800	1,442,800
S	618,900	636,400	653,900	671,400
T+S	2,061,700	2,079,200	2,096,700	2,114,200
K (millions of kilowatt-hours)	2,950	2,950	2,950	2,950
Cs	0.699	0.705	0.711	0.717
Load factor, 70 per cent:				
T	1,442,800	1,442,800	1,442,800	1,442,800
S	618,900	636,400	653,900	671,400
T+S	2,061,700	2,079,200	2,096,700	2,114,200
K (millions of kilowatt-hours)	3,442	3,442	3,442	3,442
Cs	0.599	0.604	0.609	0.614
Load factor, 80 per cent:				
T	1,442,800	1,442,800	1,442,800	1,442,800
S	618,900	636,400	653,900	671,400
T+S	2,061,700	2,079,200	2,096,700	2,114,200
K (millions of kilowatt-hours)	3,934	3,934	3,934	3,934
Cs	0.524	0.529	0.533	0.537

T=annual cost, in dollars, of transmission from Columbia River to load center.
S=annual cost, in dollars, of steam standby.
K=total energy generated at Columbia River in millions of kilowatt-hours.
Cs=cost, in mills per kilowatt-hour, of transmitting energy from Columbia River to load center, with steam standby.

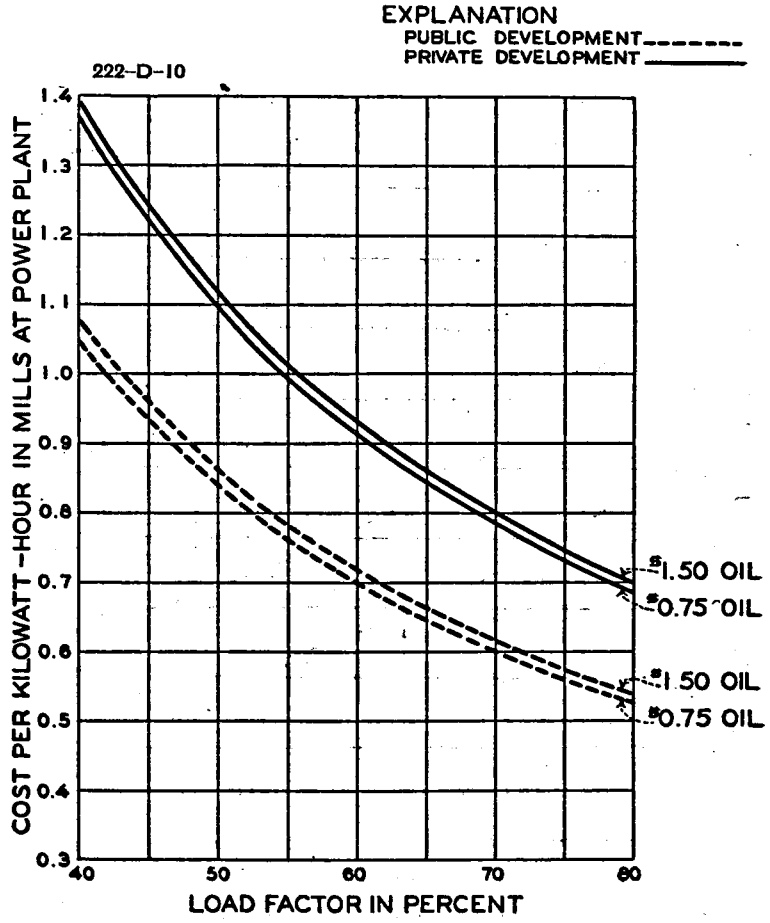
TABLE No. 13.—*Cost of transmitting energy to load center, private development, with steam stand-by, Columbia Basin project*

Cost of fuel oil per barrel	$0.75	$1.00	$1.25	$1.50
Load factor, 40 per cent:				
T	1,908,800	1,908,800	1,908,800	1,908,800
S	776,900	794,400	811,900	829,400
T+S	2,685,700	2,703,200	2,720,700	2,738,200
K (millions of kilowatt-hours)	1,967	1,967	1,967	1,967
Cs	1.365	1.374	1.383	1.392
Load factor, 50 per cent:				
T	1,908,800	1,908,800	1,908,800	1,908,800
S	776,900	794,400	811,900	829,400
T+S	2,685,700	2,703,200	2,720,700	2,738,200
K (millions of kilowatt-hours)	2,459	2,459	2,459	2,459
Cs	1.092	1.099	1.106	1.114
Load factor, 60 per cent:				
T	1,908,800	1,908,800	1,908,800	1,908,800
S	776,900	794,400	811,900	829,400
T+S	2,685,700	2,703,200	2,720,700	2,738,200
K (millions of kilowatt-hours)	2,950	2,950	2,950	2,950
Cs	0.910	0.916	0.922	0.928
Load factor, 70 per cent:				
T	1,908,800	1,908,800	1,908,800	1,908,800
S	776,900	794,400	811,900	829,400
T+S	2,685,700	2,703,200	2,720,700	2,738,200
K (millions of kilowatt-hours)	3,442	3,442	3,442	3,442
Cs	0.780	0.785	0.790	0.796
Load factor, 80 per cent:				
T	1,908,800	1,908,800	1,908,800	1,908,800
S	776,900	794,400	811,900	829,400
T+S	2,685,700	2,703,200	2,720,700	2,738,200
K (millions of kilowatt-hours)	3,934	3,934	3,934	3,934
Cs	0.683	0.687	0.692	0.696

T=annual cost, in dollars, of transmission from Columbia River to load center.
S=annual cost, in dollars, of steam stand-by.
K=total energy generated at Columbia River in millions of kilowatt-hours.
Cs=cost, in mills per kilowatt-hour, of transmitting energy from Columbia River to load center, with steam stand-by.



COST OF TRANSMITTING ENERGY FROM COLUMBIA RIVER DEVELOPMENT TO LOAD CENTER 170 MILES DISTANT WITHOUT STEAM STANDBY



COST OF TRANSMITTING ENERGY FROM COLUMBIA RIVER DEVELOPMENT TO LOAD CENTER 170 MILES DISTANT WITH STEAM STANDBY

TABLE NO. 14.—*Estimated annual value of energy at the Columbia River power plant with and without steam stand-by, assuming load center 170 miles transmission distance*

[Assumptions: Peak kilowatts generated at Columbia River hydroplant, 561,300; peak kilowatts delivered from terminal substation, 508,000; number of 220-kilovolt, 3-phase, double circuit lines, 2]

Cost of fuel oil per barrel

	Public development				Private development			
	$0.75	$1	$1.25	$1.50	$0.75	$1	$1.25	$1.50
Load factor, 40 per cent								
(Kw-hrs generated annually at Columbia River power plant, 1,967,000,000)								
(a) Annual cost of equivalent steam plant at load center (508,000 kilowatts required, 558,800 kilowatts installed)	$7,593,100	$8,559,800	$9,526,500	$10,493,200	$8,853,900	$9,820,700	$10,787,400	$11,754,100
(b) Annual cost of transmission from power plant to load center (2 double circuit lines)	$1,442,800	$1,442,800	$1,442,800	$1,442,800	$1,908,800	$1,908,800	$1,908,800	$1,908,800
(c) Annual value of power at Columbia River power plant without steam stand-by	$6,150,300	$7,117,000	$8,083,700	$9,050,400	$6,945,100	$7,911,900	$8,878,600	$9,845,30
(d) Annual cost of steam stand-by (70,000 kilowatts)	$618,900	$636,400	$653,900	$671,400	$776,900	$794,400	$811,900	$829,400
(e) Annual value of power at Columbia River power plant with steam stand-by	$5,531,400	$6,480,600	$7,429,800	$8,379,000	$6,168,200	$7,117,500	$8,066,700	$9,015,900
(f) Value of power at Columbia River power plant, in mills per kilowatt-hour without steam stand-by	3.127	3.618	4.110	4.601	3.531	4.022	4.514	5.005
(g) Value of power at Columbia River power plant, in mills per kilowatt-hour with steam stand-by	2.812	3.294	3.777	4.260	3.136	3.618	4.101	4.584
Load factor, 60 per cent								
(Kw-hrs generated annually at Columbia River power plant, 2,459,000,000)								
(a) Annual cost of equivalent steam plant at load center (508,000 kilowatts required, 558,800 kilowatts installed)	$8,260,600	$9,449,800	$10,639,000	$11,828,300	$9,521,400	$10,710,700	$11,899,900	$13,089,100
(b) Annual cost of transmission from power plant to load center (2 double circuit lines)	$1,442,800	$1,442,800	$1,442,800	$1,442,800	$1,908,800	$1,908,800	$1,908,800	$1,908,800
(c) Annual value of power at Columbia River power plant without steam stand-by	$6,817,800	$8,007,000	$9,196,200	$10,385,500	$7,612,600	$8,801,900	$9,991,100	$11,180,300
(d) Annual cost of steam stand-by (70,000 kilowatts)	$618,900	$636,400	$653,900	$671,400	$776,900	$794,400	$811,900	$829,400
(e) Annual value of power at Columbia River power plant with steam stand-by	$6,198,900	$7,370,600	$8,542,300	$9,714,100	$6,835,700	$8,007,500	$9,179,200	$10,350,900
(f) Value of power at Columbia River power plant in mills per kilowatt-hour without steam stand-by	2.773	3.256	3.740	4.224	3.096	3.579	4.063	4.547
(g) Value of power at Columbia River power plant, in mills per kilowatt-hour with steam stand-by	2.521	2.997	3.474	3.950	2.780	3.256	3.733	4.209

TABLE NO. 14.—*Estimated annual value of energy at the Columbia River power plant with and without steam stand-by, assuming load center 170 miles transmission distance*—Continued

[Assumptions: Peak kilowatts generated at Columbia River hydroplant, 561,300; peak kilowatts delivered from terminal substation, 508,000; number of 220-kilovolt, 3-phase, double circuit lines, 2]

Cost of fuel oil per barrel

	Public development				Private development			
	$0.75	$1	$1.25	$1.50	$0.75	$1	$1.25	$1.50
Load factor, 60 per cent								
(Kw-hrs generated annually at Columbia River power plant, 2,950,000,000)								
(a) Annual cost of equivalent steam plant at load center (508,000 kilowatts required, 558,800 kilowatts installed)	$8,928,100	$10,339,800	$11,751,600	$13,163,300	$10,189,000	$11,600,700	$13,012,400	$14,424,200
(b) Annual cost of transmission from power plant to load center (2 double circuit lines)	$1,442,800	$1,442,800	$1,442,800	$1,442,800	$1,908,800	$1,908,800	$1,908,800	$1,908,800
(c) Annual value of power at Columbia River power plant without steam stand-by	$7,485,300	$8,897,000	$10,308,800	$11,720,500	$8,280,200	$9,691,900	$11,103,600	$12,515,400
(d) Annual cost of steam stand-by (70,000 kilowatts)	$618,900	$636,400	$653,900	$671,400	$776,900	$794,400	$811,900	$829,400
(e) Annual value of power at Columbia River power plant with steam stand-by	$6,866,400	$8,260,600	$9,654,900	$11,049,100	$7,503,300	$8,897,500	$10,291,700	$11,686,000
(f) Value of power at Columbia River power plant in mills per kilowatt-hour without steam stand-by	2.537	3.016	3.495	3.973	2.807	3.285	3.764	4.243
(g) Value of power at Columbia River power plant, in mills per kiolwatt-hour with steam stand-by	2.328	2.800	3.273	3.745	2.543	3.016	3.489	3.961
Load factor, 70 per cent								
(Kw-hrs generated annually at Columbia River power plant, 3,442,000,000)								
(a) Annual cost of equivalent steam plant at load center (508,000 kilowatts required, 558,800 kilowatts installed)	$9,595,600	$11,229,800	$12,864,100	$14,498,300	$10,856,500	$12,490,700	$14,124,900	$15,759,200
(b) Annual cost of transmission from power plant to load center (2 double-circuit lines)	$1,442,800	$1,442,800	$1,442,800	$1,442,800	$1,908,800	$1,908,800	$1,908,800	$1,908,800
(c) Annual value of power at Columbia River power plant without steam stand-by	$8,152,800	$9,787,000	$11,421,300	$13,055,500	$8,947,700	$10,581,900	$12,216,100	$13,850,400
(d) Annual cost of steam stand-by (70,000 kilowatts)	$618,900	$636,400	$653,900	$671.400	$776,900	$794,400	$811,900	$829,400
(e) Annual value of power at Columbia River power plant with steam stand-by	$7,533,900	$9,150,600	$10,767,400	$12,384,100	$8,170.800	$9,787,500	$11,404,200	$13,021,000
(f) Value of power at Columbia River power plant, in mills per kilowatt-hour, without steam stand-by	2.369	2.843	3.318	3.793	2.600	3.074	3.549	4.024
(g) Value of power at Columbia River power plant, in mills per kilowatt-hour, with steam stand-by	2.189	2.659	3.128	3.598	2.374	2.844	3.313	3.783

Load factor, 80 per cent								
(Kw.-hrs. generated annually at Columbia River power plant, 3,934,000,000)								
(*a*) Annual cost of equivalent steam plant at load center (508,000 kilowatts required, 558,800 kilowatts installed)	$10,263,100	$12,119,900	$13,976,600	$15,833,300	$11,615,400	$13,380,700	$15,237,500	$17,094,200
(*b*) Annual cost of transmission from power plant to load center (2 double-circuit lines)	$1,442,800	$1,442,800	$1,442,800	$1,442,800	$1,908,800	$1,908,800	$1,908,800	$1,908,800
(*c*) Annual value of power at Columbia River power plant without steam stand-by	$8,820,300	$10,677,100	$12,533,800	$14,390,500	$9,706,600	$11,471,900	$13,328,700	$15,185,400
(*d*) Annual cost of steam stand-by (70,000 kilowatts)	$618,900	$636,400	$653,900	$671,400	$776,900	$794,400	$811,900	$829,400
(*e*) Annual value of power at Columbia River power plant with steam stand-by	$8,201,400	$10,040,700	$11,879,900	$13,719,100	$8,929,700	$10,677,500	$12,516,800	$14,356,000
(*f*) Value of power at Columbia River power plant, in mills per kilowatt-hour, without steam stand-by	2.242	2.714	3.186	3.658	2.467	2.916	3.388	3.860
(*g*) Value of power at Columbia River power plant, in mills per kilowatt-hour, with steam stand-by	2.085	2.552	3.020	3.487	2.270	2.714	3.182	3.649

VALUE OF ENERGY AT POWER PLANT

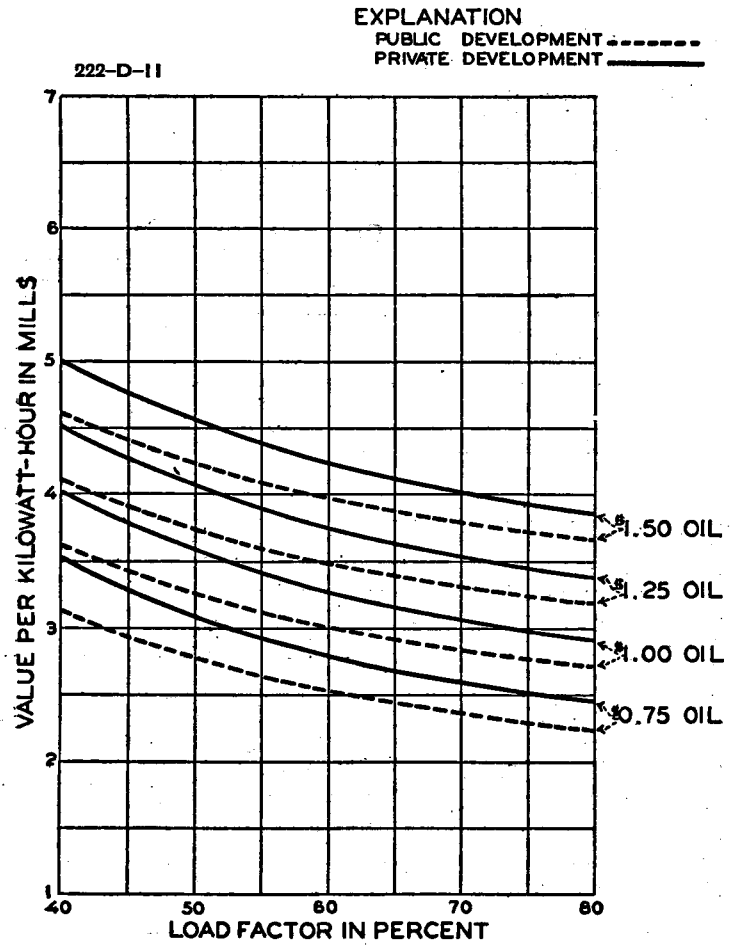
It is assumed that the Columbia River Power Plant will be constructed and operated by the Government; that the energy generated will be sold at the high voltage side of the transformers at the power plant; and that the transmission lines will be constructed and operated by the agencies which purchase the energy. Under these conditions, the value of energy at the power plant will be determined by the cost of an equivalent amount of substitute energy delivered at the terminal substations located at the load centers, less the cost of transmitting energy from the Columbia River Power Plant to the same load centers.

Drawing No. 222–D–7 shows graphically the estimated cost in mills per kilowatt-hour of energy generated by a steam-electric plant for various load factors and prices of fuel oil and for both public and private steam plants. Drawings Nos. 222–D–9 and 222–D–10 show the estimated cost of transmitting energy from the Columbia River Power Plant to the load center for various load factors and for both public and private transmission.

Table 14 shows the value of energy at the Columbia River Power Plant for various load factors, various prices of fuel oil and for both publically and privately owned and operated substitute steam plants and transmission lines, both with and without steam stand-by to supplement delivery or power over long distance transmission lines. The value of energy at the Columbia River Power Plant under the same conditions is shown graphically by the curves on drawings Nos. 222–D–11 and 222–D–12.

These curves indicate that with fuel oil costing $1 per barrel delivered, the value of energy at the Columbia River Power Plant would vary from 2.55 mills per kilowatt-hour for public ownership and operation of a substitute steam-electric plant and transmission facilities to 2.92 mills per kilowatt-hour for a privately owned and operated substitute steam-electric plant and transmission lines, both on the assumption that steam stand-by is included and that the load factor is 80 per cent.

Some margin should be allowed between the cost of substitute power from other sources and the price of Columbia River power so as to induce the various power companies and municipalities to utilize the Columbia River power in preference to power from other sources and to expedite the absorption of the Columbia River power as rapidly as possible, which is a very important factor in the financial success of the proposed power development. Based on the cost of equivalent substitute power obtained from steam-electric generating stations located at load centers and with fuel oil at $1 per barrel, the value of energy at the Columbia River Power Plant would be somewhere between 2.5 and 3.6 mills per kilowatt-hour depending on load factor and whether public or private agencies purchase the power. A price of 2.25 mills per kilowatt-hour should be sufficiently attractive to induce the power companies and municipalities to purchase energy in lieu of constructing additional power plants, either steam or hydroelectric, of their own and to insure that the Columbia River power will be absorbed as rapidly as the growth of load will permit.



VALUE OF POWER AT POWER PLANT IN MILLS PER KILOWATT-HOUR WITHOUT STEAM STANDBY

FINANCIAL RESULTS

Studies have been made of the financial operation of the proposed Columbia River development based on the following assumptions:

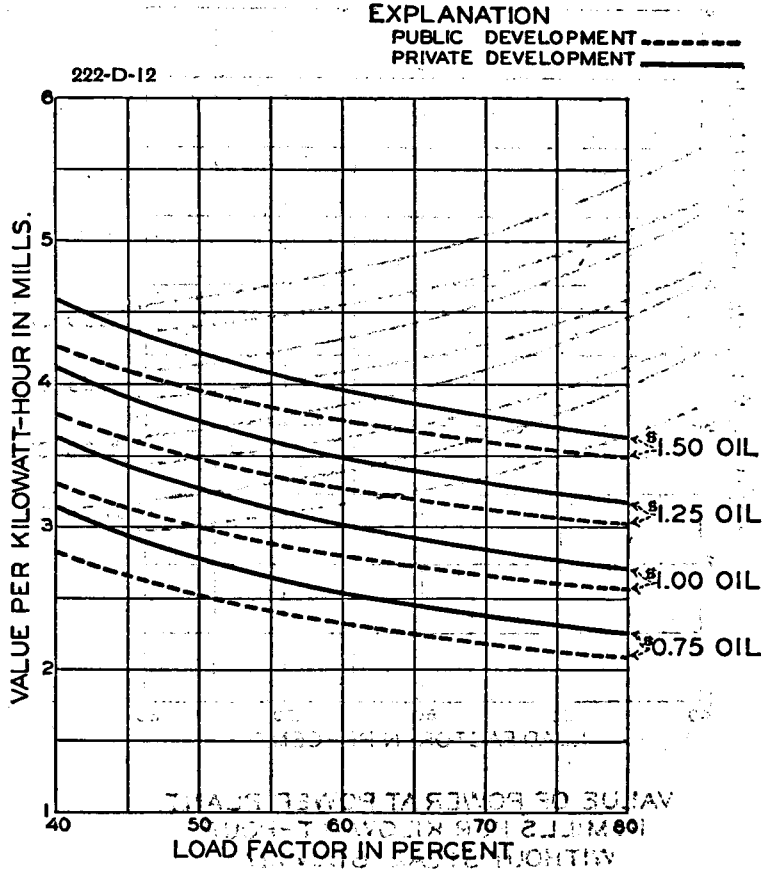
(*a*) The firm power amounting to 800,000 kilowatts of continuous power is absorbed in 15 years which corresponds to a rate of 53,300 kilowatts or 467,000,000 kilowatt-hours per year.

(*b*) The firm energy is sold at 2.25 mills per kilowatt-hour.

(*c*) Irrigation development and settlement proceeds at the rates of 20,000 acres per year.

(*d*) Secondary power for pumping purposes is paid for at the rate of $1 per acre per year which is equivalent to approximately 0.5 mills per kilowatt-hour.

(*e*) Operation of the power plant by Government forces in order to take full advantage of secondary power for irrigation pumping and thus secure the maximum returns from the installation.



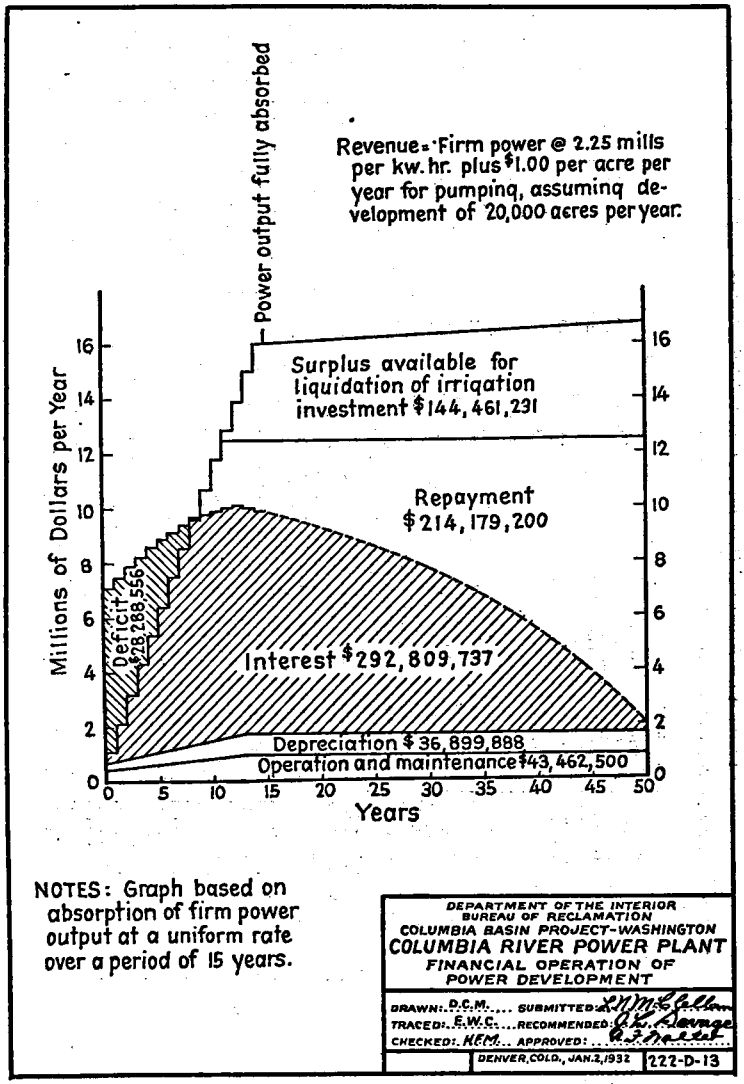
VALUE OF POWER AT POWER PLANT IN MILLS PER KILOWATT-HOUR WITH STEAM STANDBY

Based on the above assumptions, the revenue would be sufficient to repay the cost of the Columbia River Dam and Power Plant with interest at 4 per cent per annum within 50 years, in addition to providing for the operation, maintenance, and depreciation of the dam and power plant and also provide a surplus of approximately $144,-

000,000 which would be available for repayment of the cost of the irrigation development and other purposes. This financial operation is shown by Table 15 and graphically by drawing No. 13.

The absorption of the 800,000 kilowatts of continuous firm power should be accomplished within a period of 15 years without serious

222-D-13



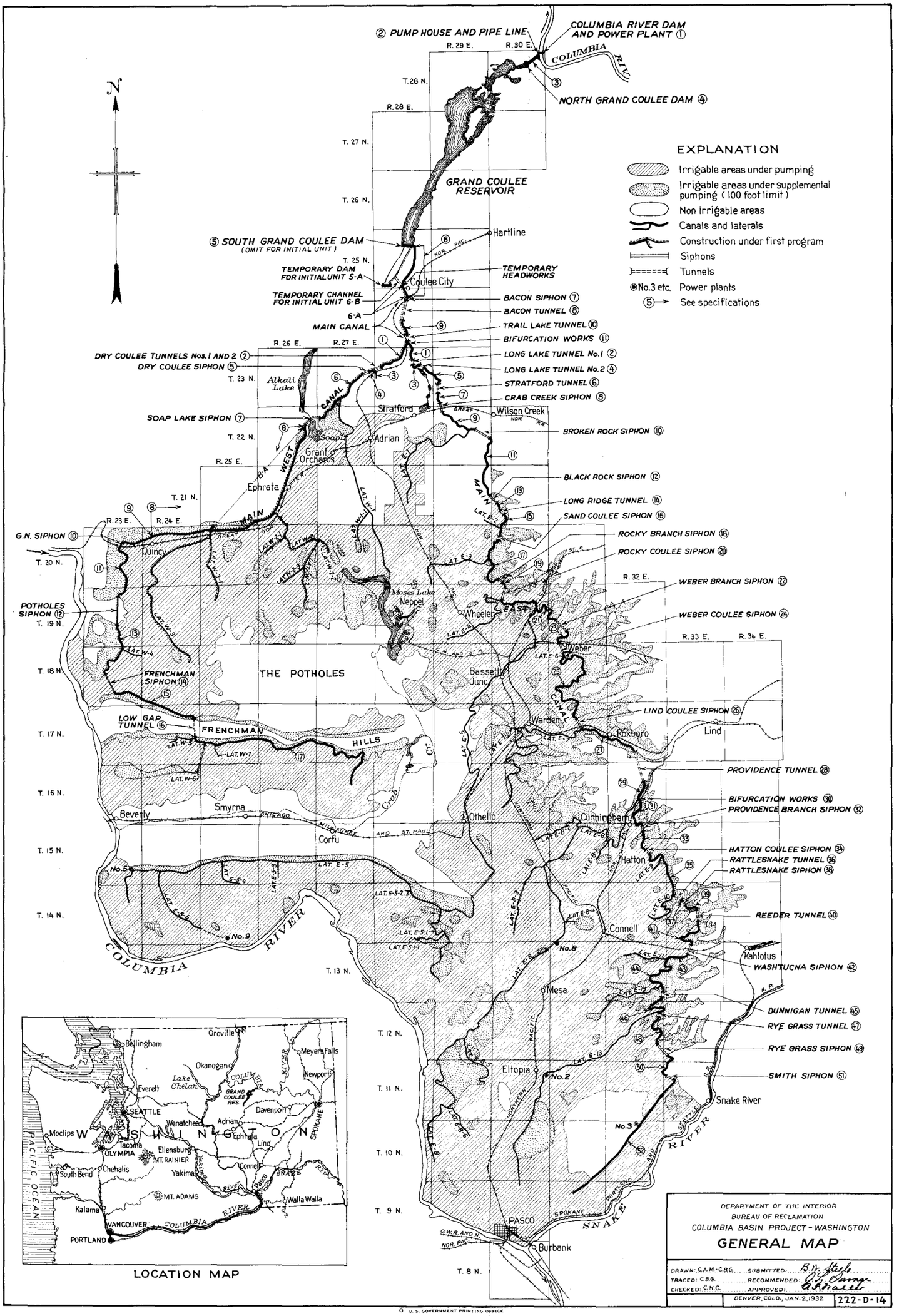
difficulty provided the power companies and municipalities will all cooperate to the fullest possible extent and if the requirement for power in the Pacific Northwest continues to increase in the future.

TABLE 15.—*Financial Operation of the Columbia Basin Project*

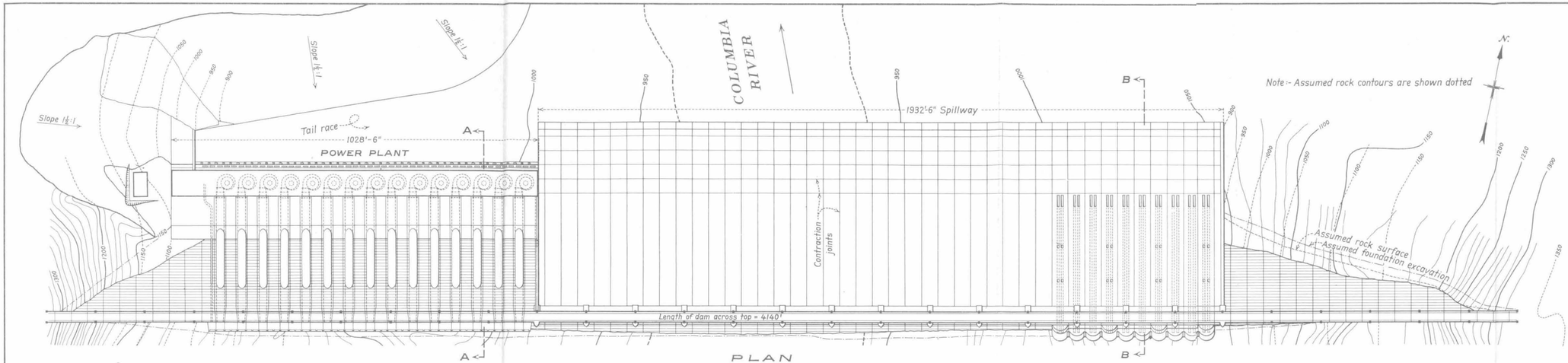
[Power sold at 2¼ mills per kilowatt-hour.—Land settled at rate of 20,000 acres per year.—Power absorption period, 15 years]

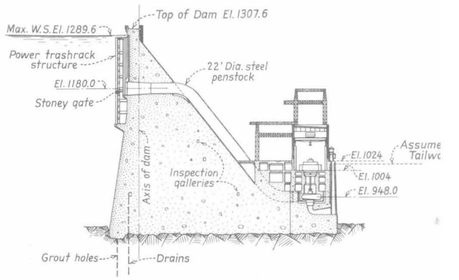
Year after completion of dam	Number units installed at beginning of year	Millions of kilowatt-hours sold, exclusive of pumping uses	Cost including interest during construction at beginning of year	Investment including interest during construction and accumulated deficit at beginning of year	Revenue from power for pumping at $1 per acre	Revenue from sale of commercial power at 2.25 mills per kilowatt-hour	Total gross revenue	Operation and maintenance	Depreciation reserve funded at 4 per cent	Interest on investment	Payment for retirement of investment	Total annual expense	Deficit	Surplus available for irrigation repayment or other purposes
1	3	467	$158,577,792	$158,577,792	$20,000	$1,050,750	$1,070,750	$412,500	$347,239	$6,343,112		$7,102,851	$6,032,101	
2	4	934	160,853,863	166,885,964	40,000	2,101,500	2,141,500	456,250	384,688	6,675,439		7,516,357	5,374,857	
3	5	1,402	163,129,934	174,536,892	60,000	3,154,500	3,214,500	500,000	422,097	6,981,476		7,903,573	4,689,073	
4	6	1,869	165,406,005	181,502,036	80,000	4,205,250	4,285,250	543,750	459,526	7,260,081		8,263,357	3,978,107	
5	7	2,336	167,682,076	187,756,214	100,000	5,256,000	5,356,000	587,500	496,955	7,510,249		8,594,704	3,238,704	
6	8	2,803	169,958,147	193,270,989	120,000	6,306,750	6,426,750	631,250	534,384	7,730,840		8,896,474	2,469,724	
7	9	3,270	172,234,218	198,016,784	140,000	7,357,500	7,497,500	675,000	571,813	7,920,671		9,167,484	1,669,984	
8	10	3,738	174,510,289	201,962,839	160,000	8,410,500	8,570,500	718,750	609,242	8,078,514		9,406,506	836,006	
9	11	4,205	176,786,360	205,074,916	180,000	9,461,250	9,641,250	762,500	646,671	8,202,907	$29,082	9,641,250		
10	12	4,672	179,062,431	207,321,905	200,000	10,512,000	10,712,000	806,250	684,100	8,292,876	928,774	10,712,000		
11	13	5,139	181,338,502	208,669,202	220,000	11,562,750	11,782,750	850,000	721,529	8,346,768	1,864,453	11,782,750		
12	14	5,606	183,614,573	209,080,820	240,000	12,613,500	12,853,500	893,750	758,958	8,363,233	2,312,601	12,328,542		$524,958
13	15	6,074	185,890,644	209,044,290	260,000	13,666,500	13,926,500	937,500	796,387	8,361,772	2,431,582	12,527,241		1,399,259
14	15	6,541	185,890,644	206,612,708	280,000	14,717,250	14,997,250	937,500	796,387	8,264,508	2,528,846	12,527,241		2,470,009
15	15	7,008	185,890,644	204,083,862	300,000	15,768,000	16,068,000	937,500	796,387	8,163,354	2,630,000	12,527,241		3,540,759
16	15	7,008	185,890,644	201,453,862	320,000	15,768,000	16,088,000	937,500	796,387	8,058,154	2,735,200	12,527,241		3,560,759
17	15	7,008	185,890,644	198,718,662	340,000	15,768,000	16,108,000	937,500	796,387	7,948,746	2,844,608	12,527,241		3,580,759
18	15	7,008	185,890,644	195,874,054	360,000	15,768,000	16,128,000	937,500	796,387	7,834,962	2,958,392	12,527,241		3,600,759
19	15	7,008	185,890,644	192,915,662	380,000	15,768,000	16,148,000	937,500	796,387	7,716,626	3,076,728	12,527,241		3,620,759
20	15	7,008	185,890,644	189,838,934	400,000	15,768,000	16,168,000	937,500	796,383	7,593,557	3,199,797	12,527,241		3,640,759
21	15	7,008	185,890,644	186,639,137	420,000	15,768,000	16,188,000	937,500	796,387	7,465,565	3,327,789	12,527,241		3,660,759
22	15	7,008	185,890,644	183,311,348	440,000	15,768,000	16,208,000	937,500	796,387	7,332,454	3,460,900	12,527,241		3,680,759
23	15	7,008	185,890,644	179,850,448	460,000	15,768,000	16,228,000	937,500	796,387	7,194,018	3,599,336	12,527,241		3,700,759
24	15	7,008	185,890,644	176,251,112	480,000	15,768,000	16,248,000	937,500	796,387	7,050,044	3,743,310	12,527,241		3,720,759
25	15	7,008	185,890,644	172,507,802	500,000	15,768,000	16,268,000	937,500	796,387	6,900,312	3,893,042	12,527,241		3,740,759
26	15	7,008	185,890,644	168,614,760	520,000	15,768,000	16,288,000	937,500	796,387	6,744,590	4,048,764	12,527,241		3,760,759
27	15	7,008	185,890,644	164,565,996	540,000	15,768,000	16,308,000	937,500	796,387	6,582,640	4,210,714	12,527,241		3,780,759
28	15	7,008	815,890,644	160,355,282	560,000	15,768,000	16,328,000	937,500	796,387	6,414,211	4,379,143	12,527,241		3,800,759
29	15	7,008	185,890,644	155,976,139	580,000	15,768,000	16,348,000	937,500	796,387	6,239,046	4,554,308	12,527,241		3,820,759
30	15	7,008	185,890,644	151,421,831	600,000	15,768,000	16,368,000	937,500	796,387	6,056,873	4,736,481	12,527,241		3,840,759
31	15	7,008	185,890,644	146,685,350	620,000	15,768,000	16,388,000	937,500	796,387	5,867,414	4,925,940	12,527,241		3,860,759
32	15	7,008	185,890,644	141,759,410	640,000	15,768,000	16,408,000	937,500	796,387	5,670,376	5,122,978	12,527,241		3,880,759

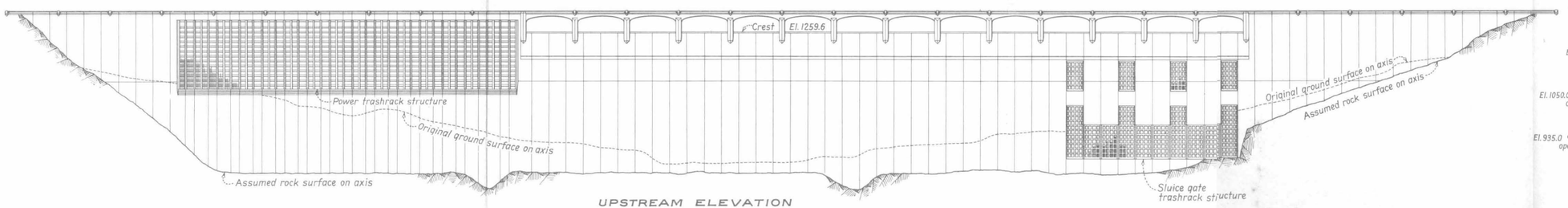
33	15	7,008	185,890,644	136,636,432	660,000	15,768,000	16,428,000	937,500	796,387	5,465,457	5,327,897	12,527,241		3,900,759
34	15	7,008	185,890,644	131,308,535	680,000	15,768,000	16,448,000	937,500	796,387	5,252,341	5,541,013	12,527,241		3,920,759
35	15	7,008	185,890,644	125,767,522	700,000	15,768,000	16,468,000	937,500	796,387	5,030,701	5,762,653	12,527,241		3,940,759
36	15	7,008	185,890,644	120,004,869	720,000	15,768,000	16,488,000	937,500	796,387	4,800,195	5,993,159	12,527,241		3,960,759
37	15	7,008	185,890,644	114,011,710	740,000	15,768,000	16,508,000	937,500	796,387	4,560,468	6,232,886	12,527,241		3,980,759
38	15	7,008	185,890,644	107,778,824	760,000	15,768,000	16,528,000	937,500	796,387	4,311,153	6,482,201	12,527,241		4,000,759
39	15	7,008	185,890,644	101,296,623	780,000	15,768,000	16,548,000	937,500	796,387	4,051,865	6,741,489	12,527,241		4,020,759
40	15	7,008	185,890,644	94,555,134	800,000	15,768,000	16,568,000	937,500	796,387	2,782,205	7,011,149	12,527,241		4,040,759
41	15	7,008	185,890,644	87,543,985	820,000	15,768,000	16,588,000	937,500	796,387	3,501,759	7,291,595	12,527,241		4,060,759
42	15	7,008	185,890,644	80,252,390	840,000	15,768,000	16,608,000	937,500	796,387	3,210,096	7,583,258	12,527,241		4,080,759
43	15	7,008	185,890,644	72,669,132	860,000	15,768,000	16,628,000	937,500	796,387	2,906,765	7,886,589	12,527,560		4,100,759
44	15	7,008	185,890,644	64,782,543	880,000	15,768,000	16,648,000	937,500	796,387	2,591,302	8,202,052	12,527,241		4,120,759
45	15	7,008	185,809,644	56,580,491	900,000	15,768,000	16,668,000	937,500	796,387	2,263,220	8,530,134	12,527,241		4,140,759
46	15	7,008	185,890,644	48,050,357	920,000	15,768,000	16,688,000	937,500	796,387	1,922,014	8,871,340	12,527,241		4,160,759
47	15	7,008	185,890,644	39,179,017	940,000	15,768,000	16,708,000	937,500	796,387	1,567,161	9,226,193	12,527,241		4,180,759
48	15	7,008	185,890,644	29,952,824	960,000	15,768,000	16,728,000	937,500	796,387	1,198,113	9,595,241	12,527,241		4,200,759
49	15	7,008	185,890,644	20,357,583	980,000	15,768,000	16,748,000	937,500	796,387	814,303	9,979,051	12,527,241		4,220,759
50	15	7,008	185,890,644	10,378,532	1,000,000	15,768,000	16,768,000	937,500	796,387	415,141	10,378,532	12,527,560		4,240,440
51	15	7,008	185,890,644		1,020,000	15,768,000	16,788,000	937,500	796,387			1,733,887		15,054,113
52	15	7,008	185,890,644		1,040,000	15,768,000	16,808,000	937,500	796,387			1,733,887		15,074,113
53	15	7,008	185,890,644		1,060,000	15,768,000	16,828,000	937,500	796,387			1,733,887		15,094,113
54	15	7,008	185,890,644		1,080,000	15,768,000	16,848,000	937,500	796,387			1,733,887		15,114,113
55	15	7,008	185,890,644		1,100,000	15,768,000	16,868,000	937,500	796,387			1,733,887		15,134,113
56	15	7,008	185,890,644		1,120,000	15,768,000	16,888,000	937,500	796,387			1,733,887		15,154,113
57	15	7,008	185,890,644		1,140,000	15,768,000	16,908,000	937,500	796,387			1,733,887		15,174,113
58	15	7,008	185,890,644		1,160,000	15,768,000	16,928,000	937,500	796,387			1,733,887		15,194,113
59	15	7,008	185,890,644		1,180,000	15,768,000	16,948,000	937,500	796,387			1,733,887		15,214,113
60	15	7,008	185,890,644		1,199,430	15,768,000	16,967,430	937,500	796,387			1,733,887		15,233,543

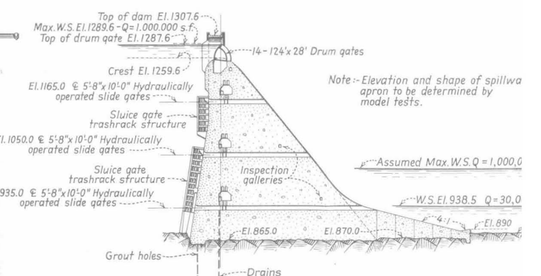


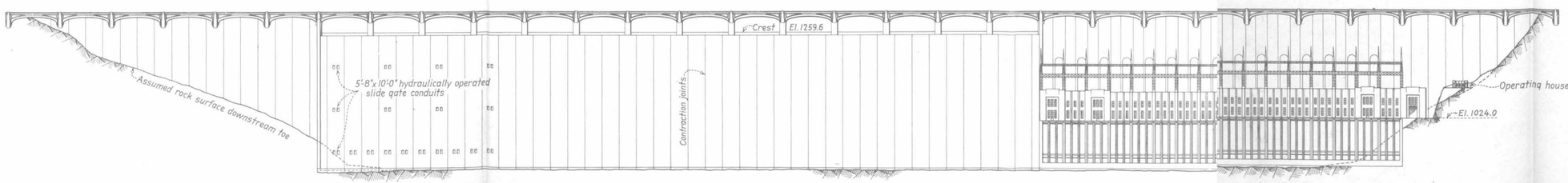
U. S. GOVERNMENT PRINTING OFFICE







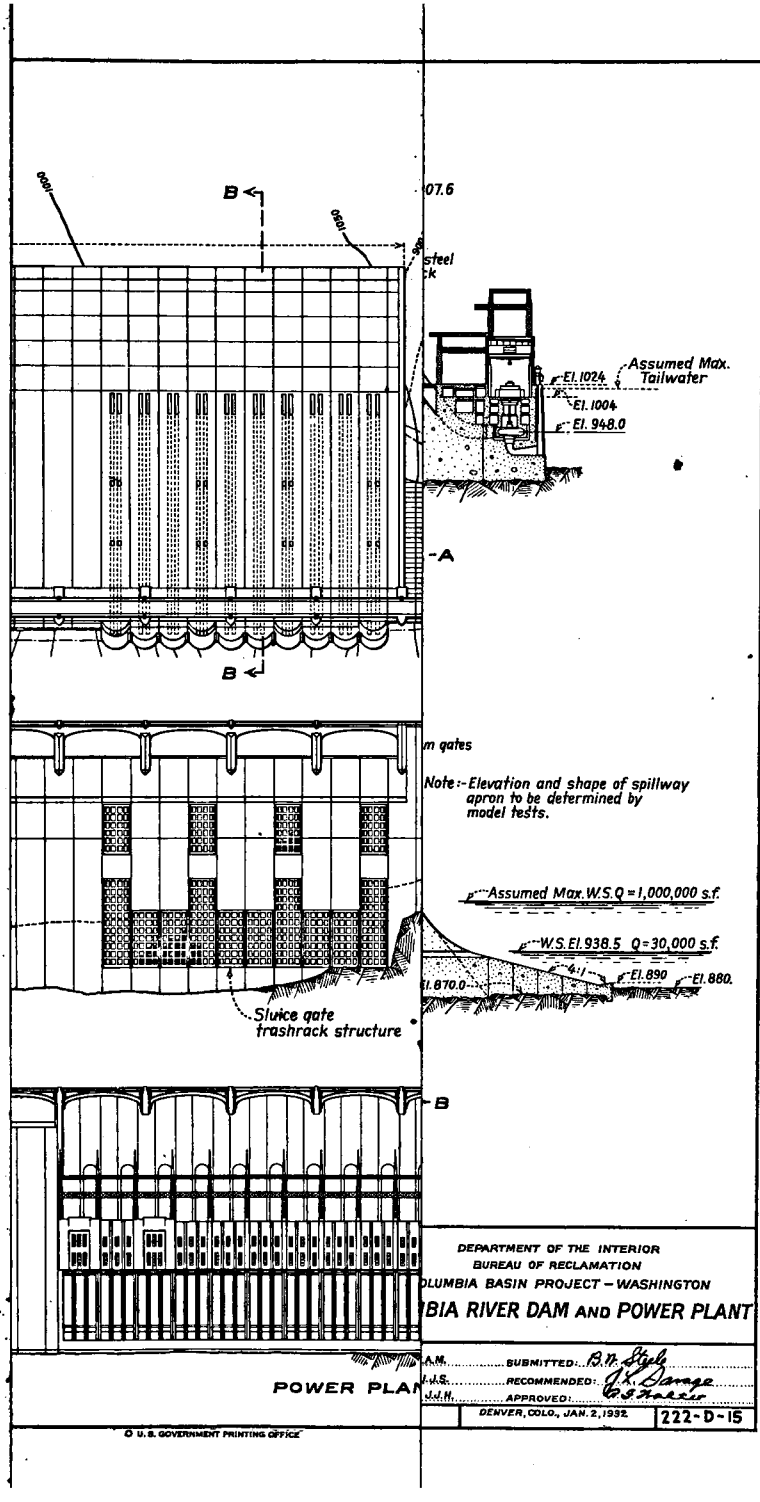




DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT — WASHING

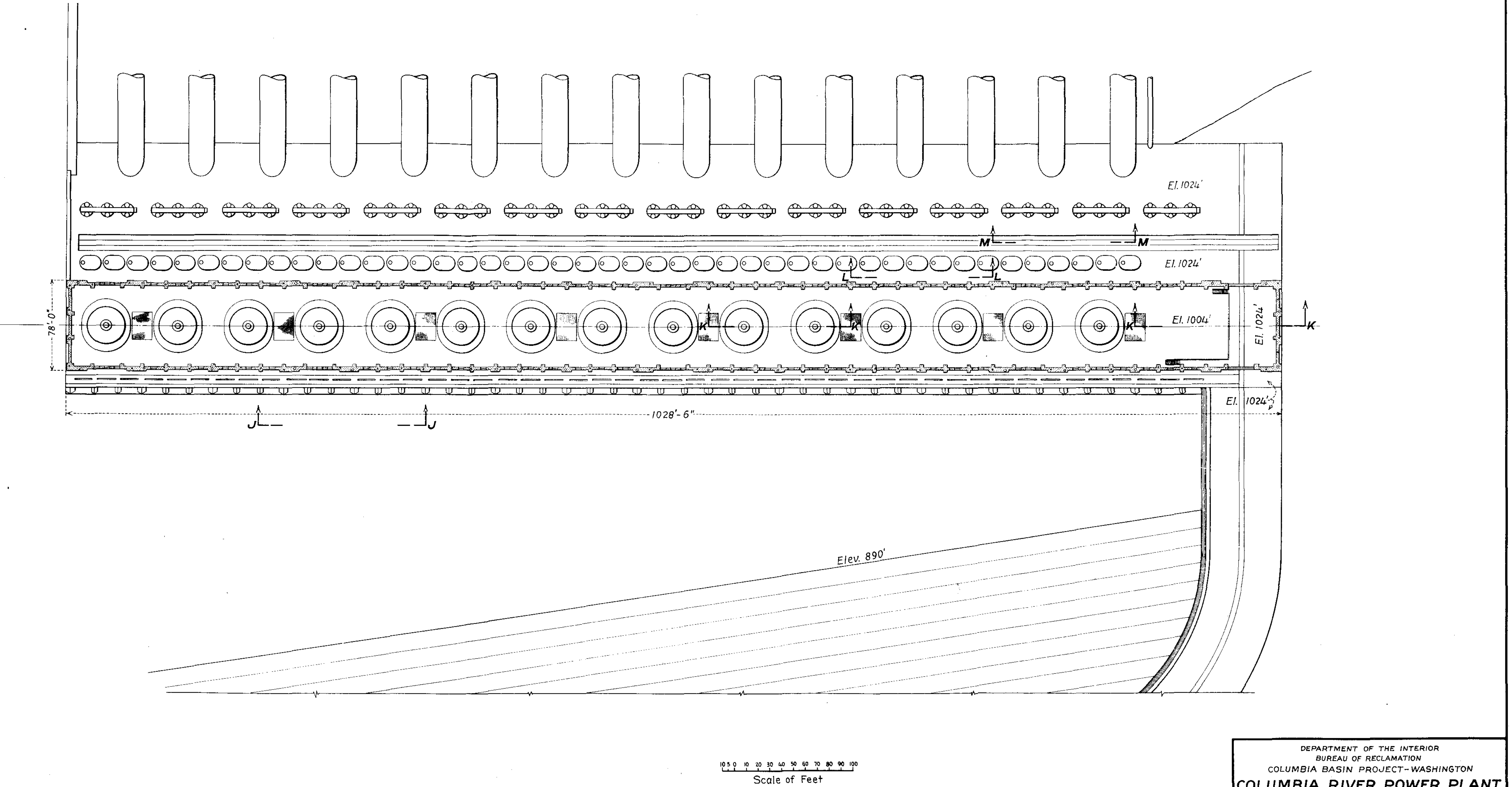
COLUMBIA RIVER DAM AND POWER

DRAWN: C.A.M.	SUBMITTED:		
TRACED: J.J.S.	RECOMMENDED:		
CHECKED: J.J.H.	APPROVED:		
	DENVER, COLO., JAN. 2, 1932.		22



DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT — WASHINGTON
COLUMBIA RIVER DAM AND POWER PLANT

A.N.	SUBMITTED: B.N. Steele	
J.V.S.	RECOMMENDED: J.V. Savage	
J.J.H.	APPROVED: C.S. Frazier	
	DENVER, COLO., JAN. 2, 1932.	222-D-15

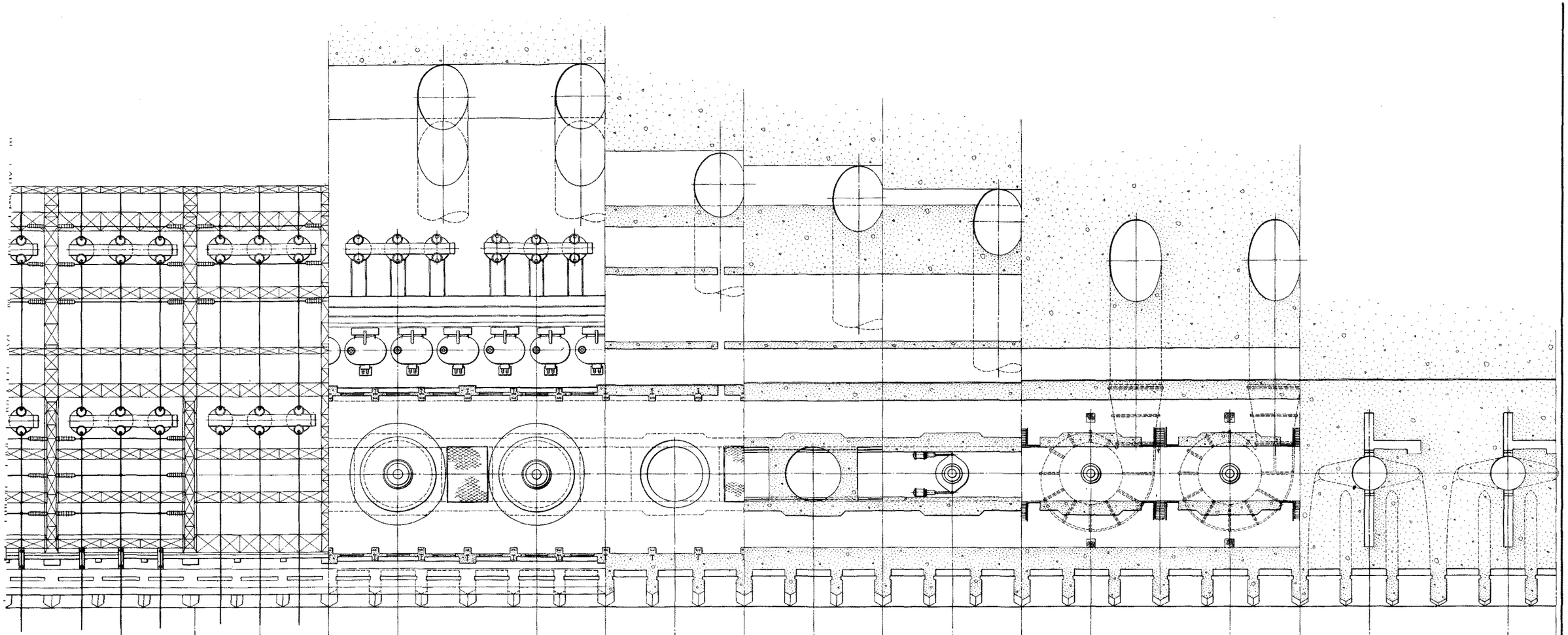


DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT-WASHINGTON

COLUMBIA RIVER POWER PLANT
GENERAL PLAN

DRAWN: M.H.K.-D.C.M. SUBMITTED: L.N. McClellan
TRACED: C.E.M. RECOMMENDED: J.L. Savage
CHECKED: M.H.K.-H.F.M. APPROVED: A.J. Walter

DENVER, COLO., JAN. 2, 1932 | 222-D-16



NOTE:
For location of sections, see Dwg. No. 222-D-18

10 0 10 20 30 40 50 60 70 80 90 100
Scale of Feet

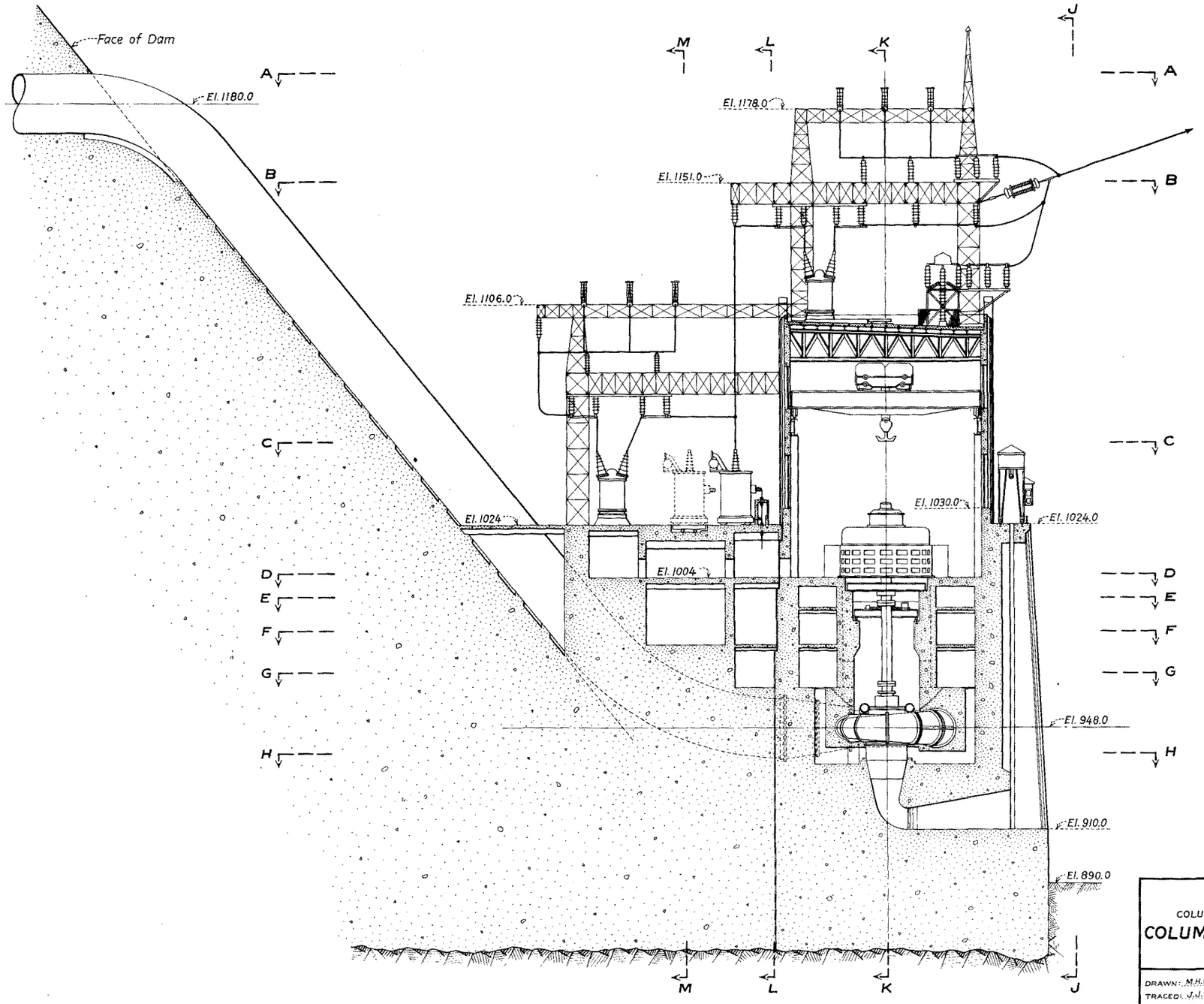
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT-WASHINGTON

COLUMBIA RIVER POWER PLANT
PARTIAL PLANS

DRAWN: M.H.K.-D.C.M. SUBMITTED: E.M. McGlellan
TRACED: C.E.M. RECOMMENDED: O.L. Savage
CHECKED: MHK-HFM. APPROVED: O.S. Baker

DENVER, COLO., JAN. 2, 1932 | 222-D-17

O U. S. GOVERNMENT PRINTING OFFICE



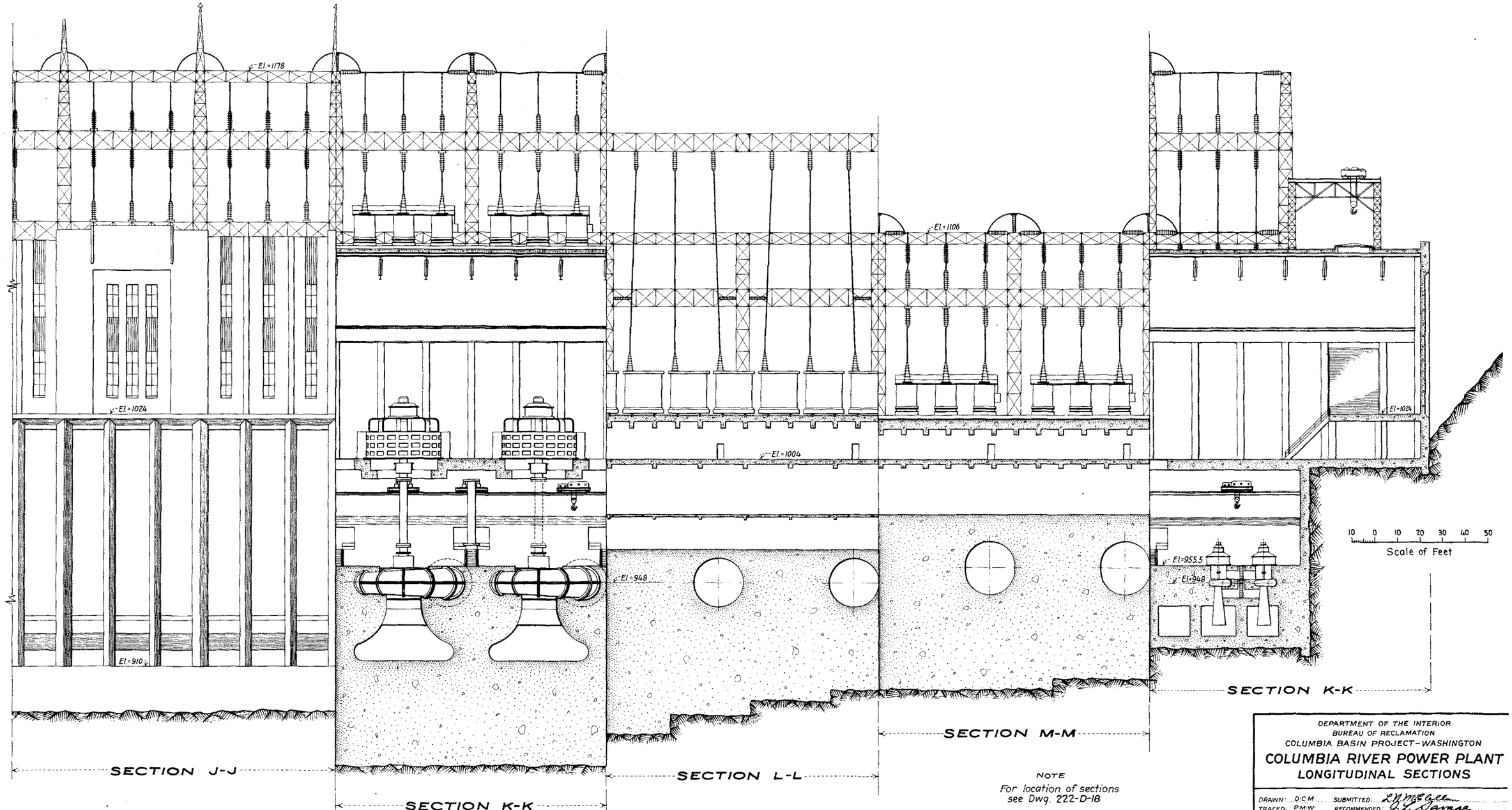
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT - WASHINGTON

COLUMBIA RIVER POWER PLANT
TYPICAL SECTION

DRAWN: M.H.K. - D.C.M. SUBMITTED: L.N. McClure
TRACED: J.J.S. RECOMMENDED: J.L. Savage
CHECKED: MHK - HFM APPROVED: O.S. Walker

DENVER, COLO., JAN. 2, 1932 | 222-D-18

O U. S. GOVERNMENT PRINTING OFFICE



NOTE
For location of sections
see Dwg. 222-D-18

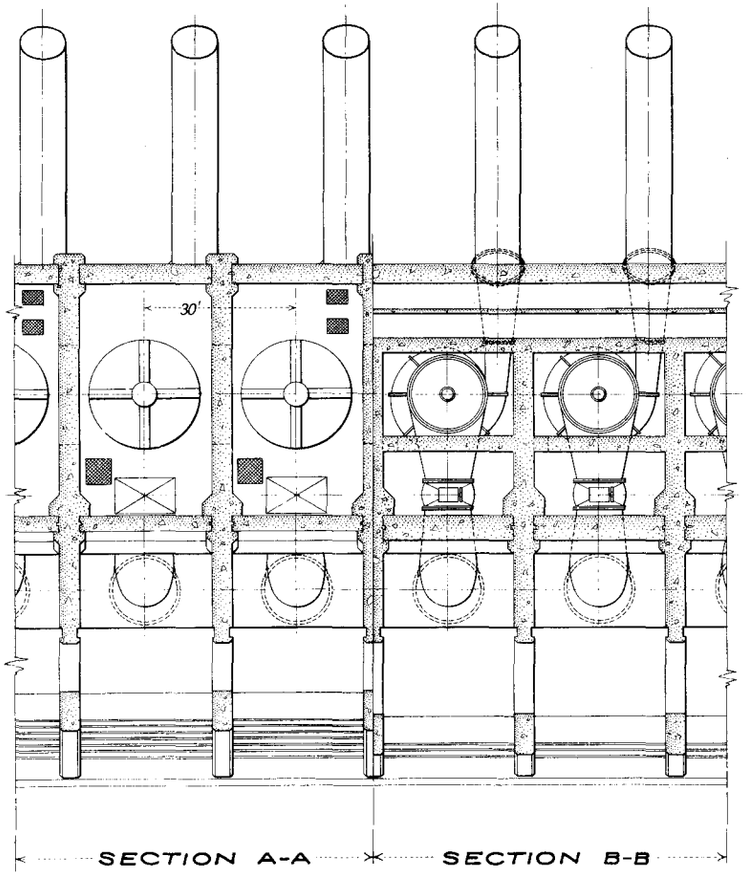
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT—WASHINGTON

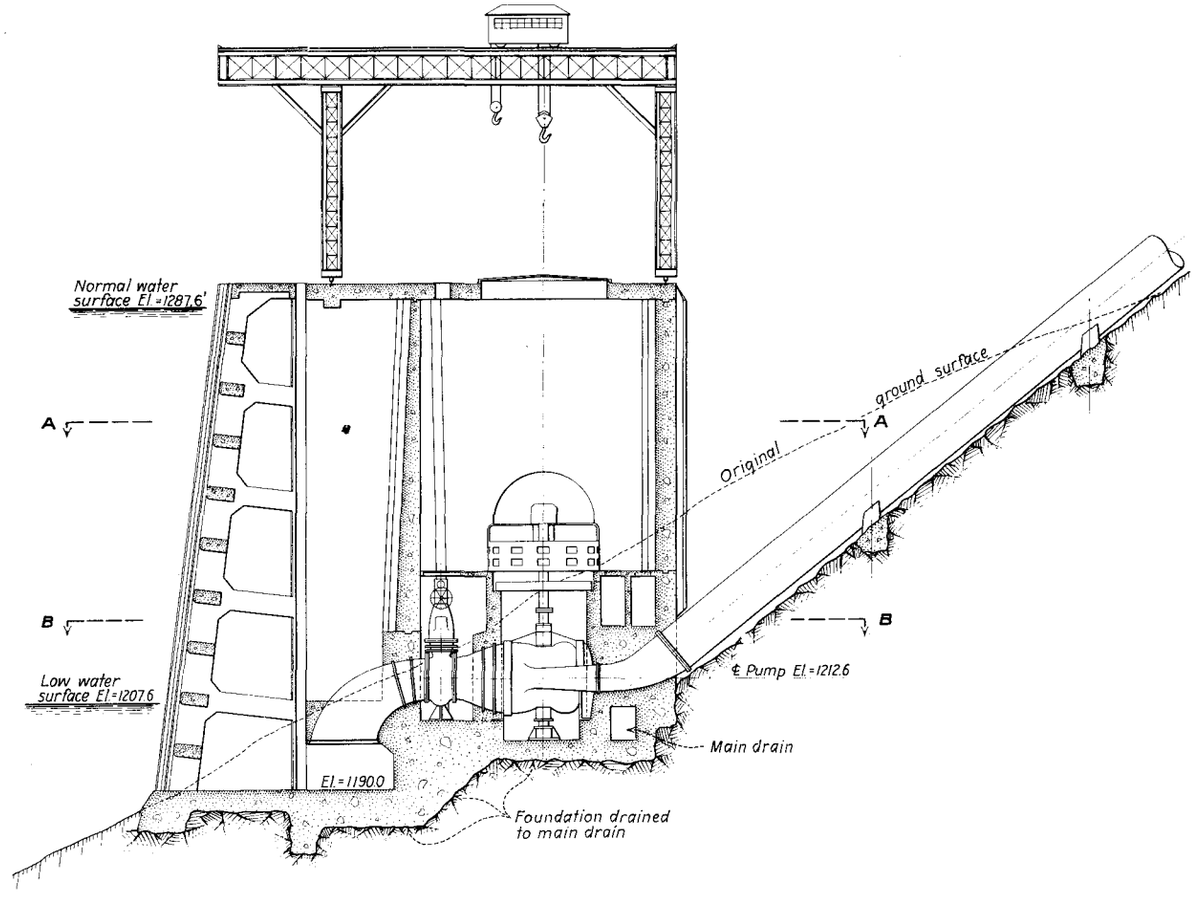
COLUMBIA RIVER POWER PLANT
LONGITUDINAL SECTIONS

DRAWN: D.C.M. SUBMITTED: L.N. McClellan
TRACED: P.M.W. RECOMMENDED: U.J. Danga
CHECKED: M.H.K.-H.F.M. APPROVED: A.S. Matter

DENVER, COLO., JAN. 2, 1932 222-D-19

O U. S. GOVERNMENT PRINTING OFFICE





10 0 10 20 30 40 50
Scale of Feet

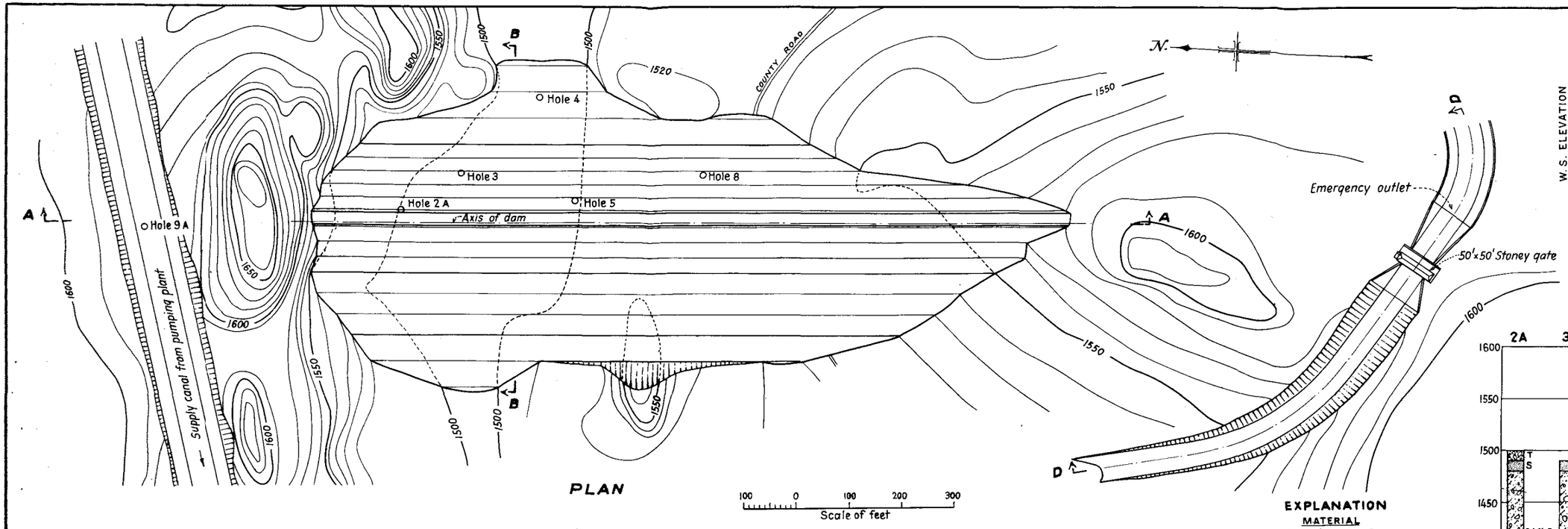
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT-WASHINGTON

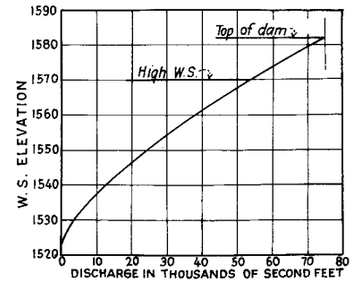
COLUMBIA RIVER PUMPING PLANT
TYPICAL SECTIONS

DRAWN	D.C.M.	SUBMITTED	L.N.McClellan
TRACED	P.M.W.	RECOMMENDED	A.J.Savage
CHECKED	D.C.M.-H.F.M.	APPROVED	[illegible]

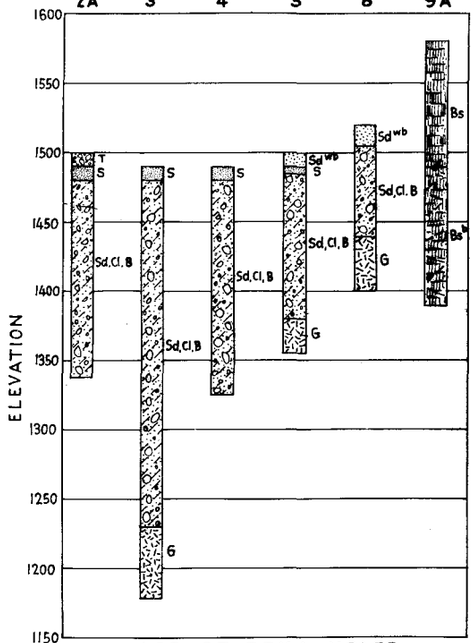
DENVER, COLO., JAN. 2, 1932 | 222-D-20

O U. S. GOVERNMENT PRINTING OFFICE





EMERGENCY SPILLWAY



LOG OF DRILL HOLES

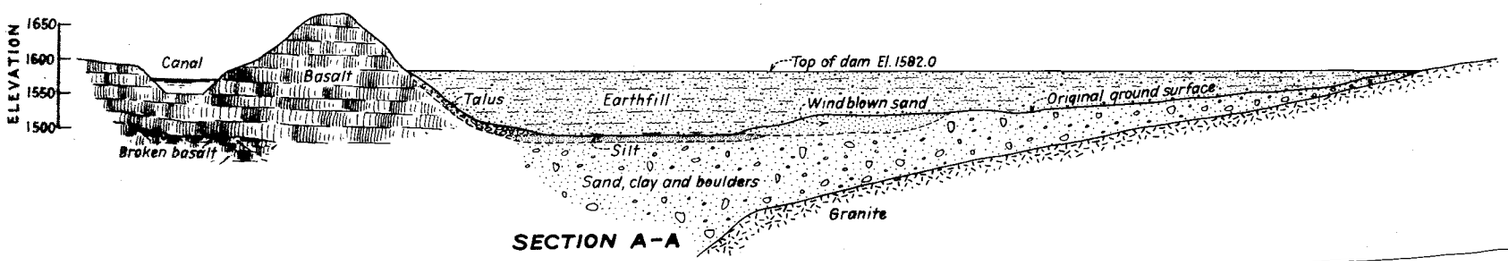
EXPLANATION

MATERIAL

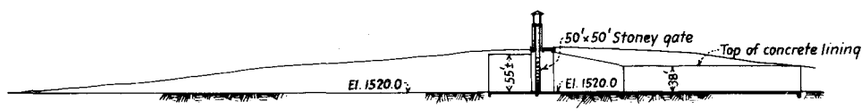
Basalt	Bs
Boulders	B
Clay	Cl.
Granite	G
Sand	Sd
Silt	S
Talus	T

DESCRIPTIVE

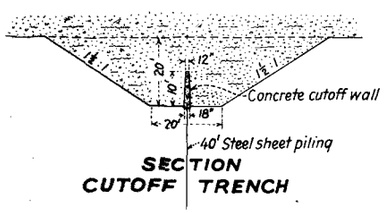
Broken	b
Windblown	wb



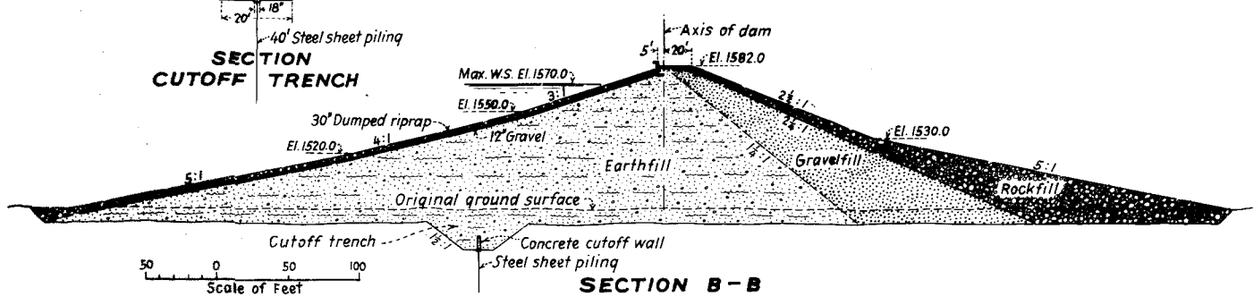
SECTION A-A



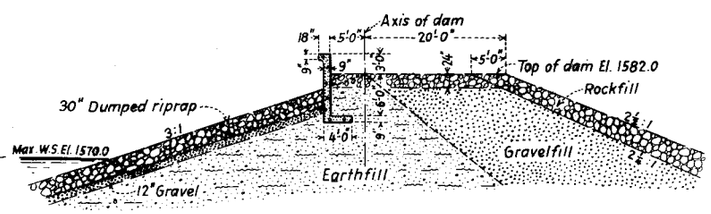
SECTION D-D



SECTION CUTOFF TRENCH



SECTION B-B



DETAIL — TOP OF DAM

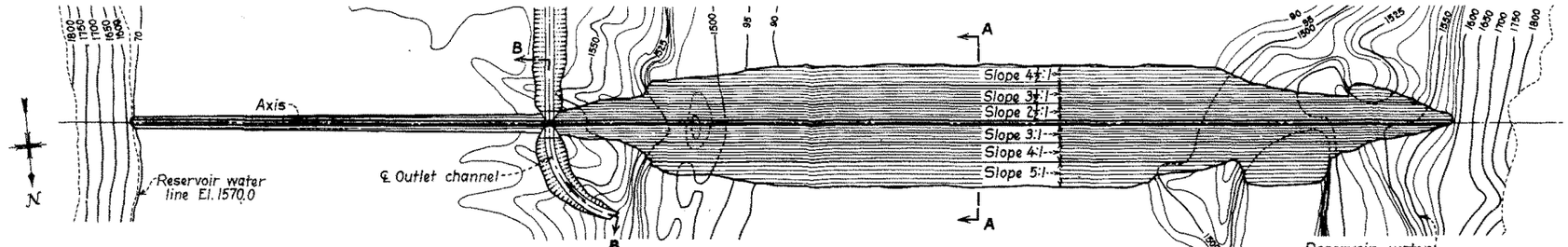
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT - WASHINGTON

NORTH GRAND COULEE DAM

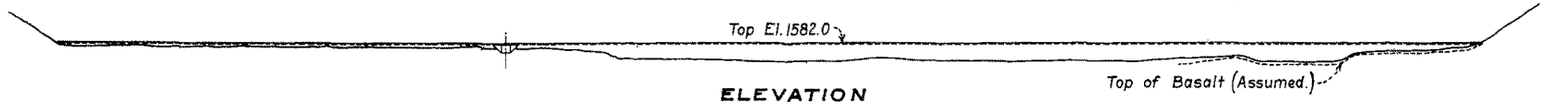
DRAWN: E.R.S. SUBMITTED: R.N. Stucky
TRACED: R.McC. RECOMMENDED: J.S. Savage
CHECKED: O.C.S. APPROVED: C.J. Peterson

DENVER, COLO., JAN. 2, 1932 — 222-D-21

O U. S. GOVERNMENT PRINTING OFFICE

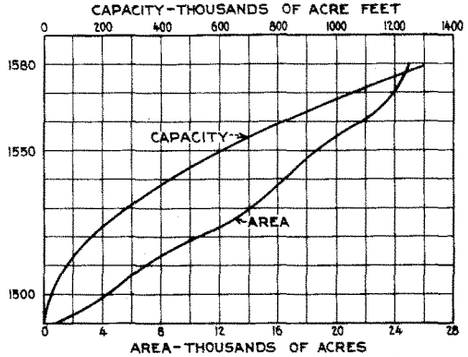


PLAN

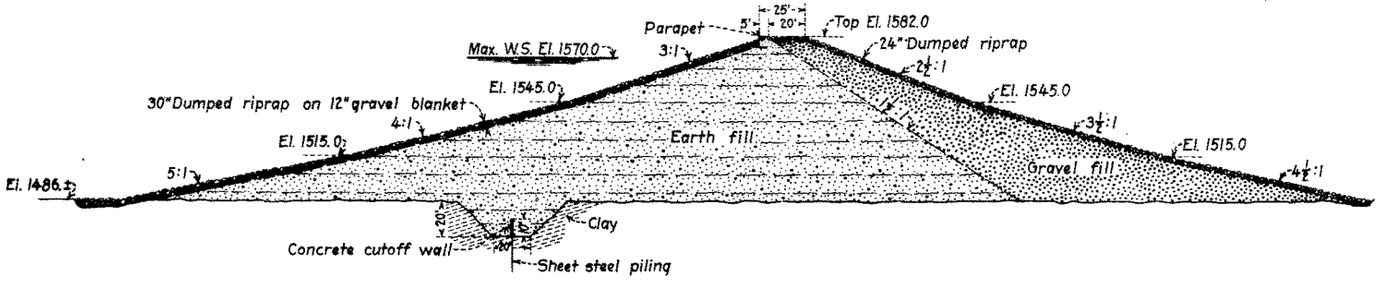


ELEVATION

Scale of Feet

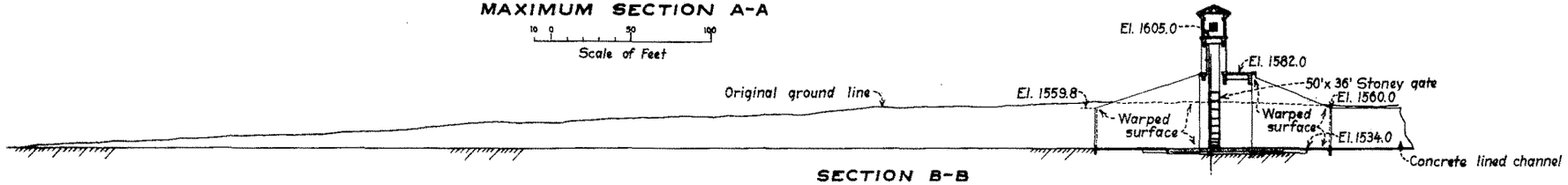


AREA AND CAPACITY CURVES

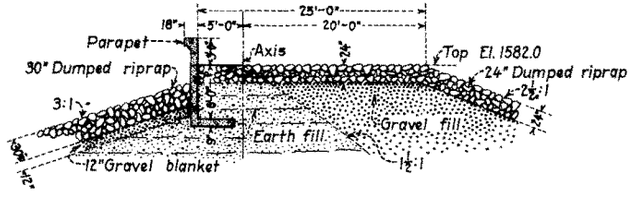


MAXIMUM SECTION A-A

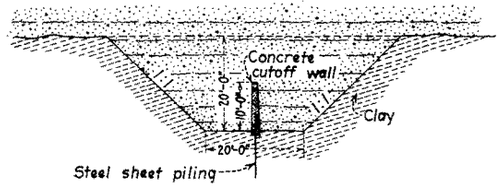
Scale of Feet



SECTION B-B



DETAIL - TOP OF DAM



CUTOFF TRENCH

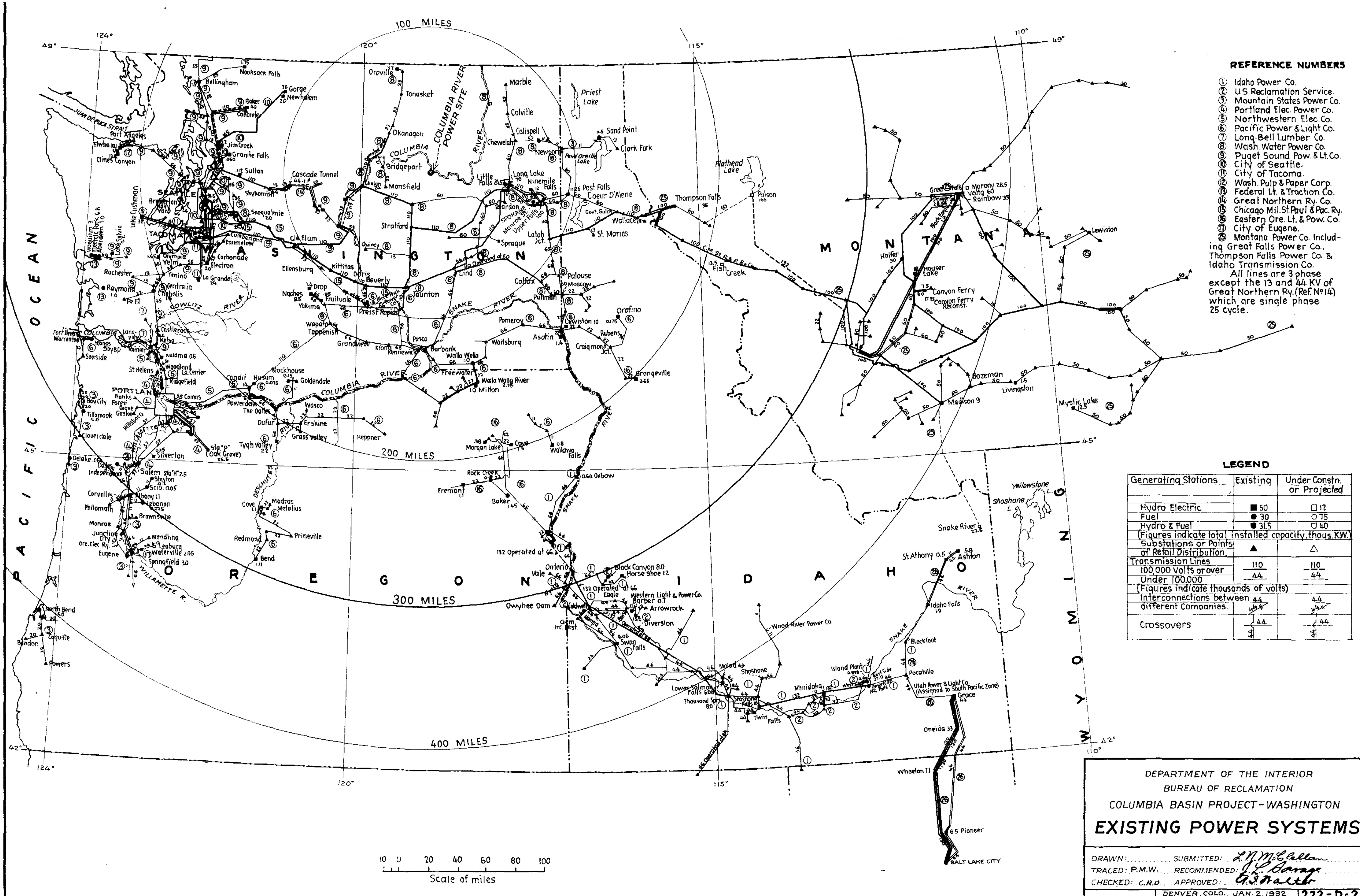
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT - WASHINGTON

SOUTH GRAND COULEE DAM

DRAWN: C.A.M. SUBMITTED: B.N. Steele
TRACED: L.D.B. RECOMMENDED: J.L. Savage
CHECKED: R.A.S. APPROVED: Ivanhoe

DENVER, COLO., JAN. 2, 1932 222-D-22

O U. S. GOVERNMENT PRINTING OFFICE



REFERENCE NUMBERS

1. Idaho Power Co.
2. U.S. Reclamation Service.
3. Mountain States Power Co.
4. Portland Elec. Power Co.
5. Northwestern Elec. Co.
6. Pacific Power & Light Co.
7. Long-Bell Lumber Co.
8. Wash. Water Power Co.
9. Puget Sound Pow. & Lt. Co.
10. City of Seattle.
11. City of Tacoma.
12. Wash. Pulp & Paper Corp.
13. Federal Lt. & Traction Co.
14. Great Northern Ry. Co.
15. Chicago Mil. St. Paul & Pac. Ry.
16. Eastern Ore. Lt. & Pow. Co.
17. City of Eugene.
25. Montana Power Co. Including Great Falls Power Co., Thompson Falls Power Co. & Idaho Transmission Co.

All lines are 3 phase except the 13 and 44 KV of Great Northern Ry. (Ref. No 14) which are single phase 25 cycle.

LEGEND

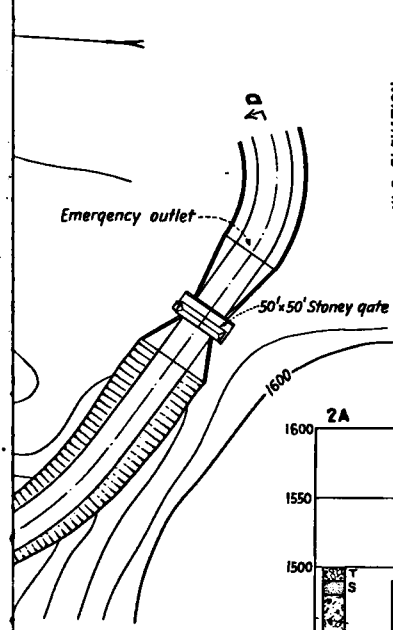
Generating Stations	Existing	Under Constn. or Projected
Hydro Electric	■ 50	□ 12
Fuel	● 30	○ 75
Hydro & Fuel	31.5	40
(Figures indicate total installed capacity, thous. KW.)		
Substations or Points of Retail Distribution.	▲	△
Transmission Lines 100,000 Volts or over	110	110
Under 100,000	44	44
(Figures indicate thousands of volts)		
Interconnections between different Companies.	44	44
Crossovers	44	44

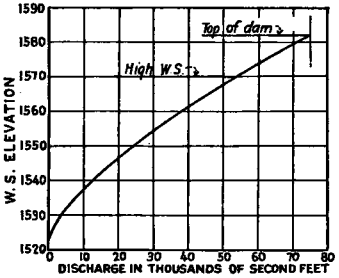
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT - WASHINGTON

EXISTING POWER SYSTEMS

DRAWN: .... SUBMITTED: L. N. McClellan
TRACED: P.M.W. RECOMMENDED: J. L. Savage
CHECKED: C.R.D. APPROVED: G. J. Walter

DENVER, COLO., JAN. 2, 1932 | 222-D-23





EMERGENCY SPILLWAY

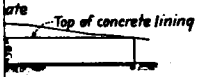
EXPLANATION

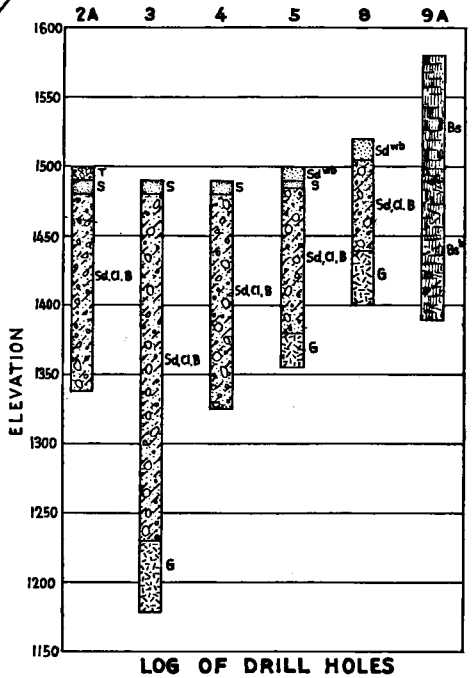
MATERIAL

Basalt	Bs
Boulders	B
Clay	Cl.
Granite	G
Sand	Sd
Silt	S
Talus	T

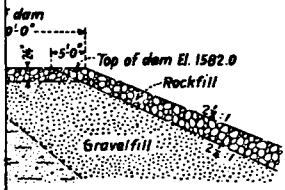
DESCRIPTIVE

Broken	b
Windblown	wb





LOG OF DRILL HOLES

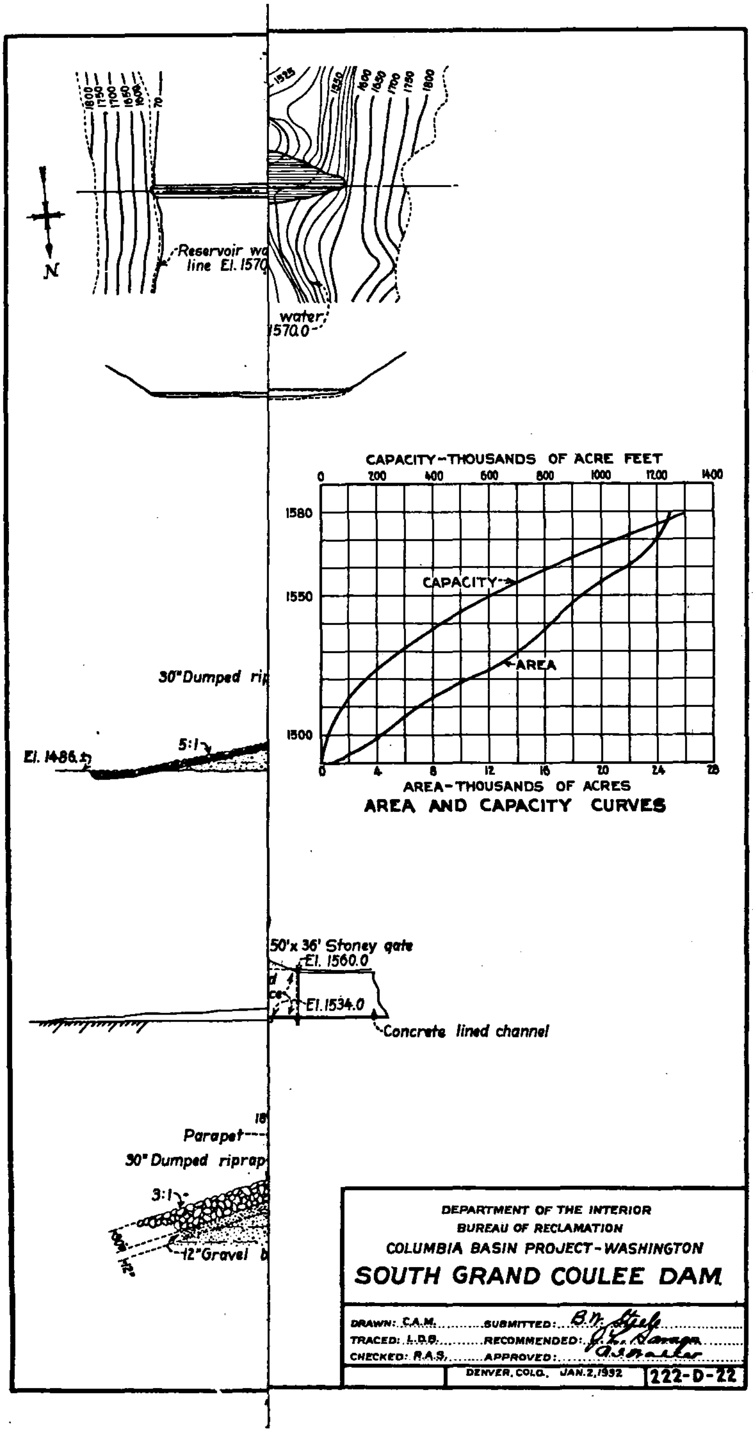


TOP OF DAM

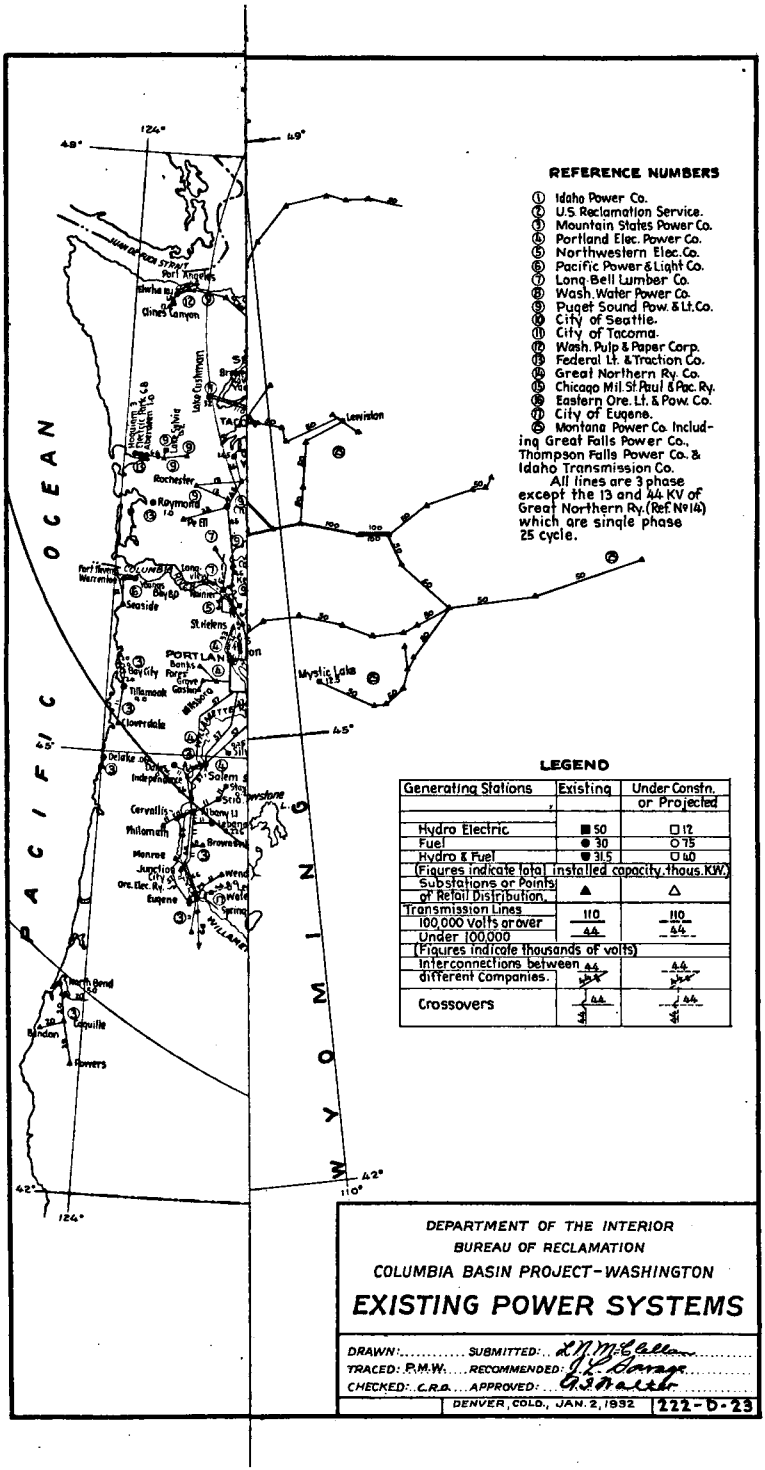
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT - WASHINGTON

NORTH GRAND COULEE DAM

DRAWN: E.R.S.	SUBMITTED:		
TRACED: R.McC.	RECOMMENDED:		
CHECKED: O.C.S.	APPROVED:		
	DENVER, COLO., JAN. 2, 1932		222-D-21



1800
1750
1700
1650
1600
70
1525
1550
1600
1650
1700
1750
1800
N
Reservoir wa
line El. 1570
water
1570.0
CAPACITY-THOUSANDS OF ACRE FEET
0
200
400
600
800
1000
1200
1400
1580
1550
1500
CAPACITY
AREA
0
4
8
12
16
20
24
28
AREA-THOUSANDS OF ACRES
AREA AND CAPACITY CURVES
30"Dumped rip
El. 1486.±
5:1
50'x 36' Stoney gate
El. 1560.0
El. 1534.0
Concrete lined channel
Parapet
30" Dumped riprap
3:1
12"Gravel b
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT-WASHINGTON
SOUTH GRAND COULEE DAM
DRAWN: C.A.M.
SUBMITTED:
TRACED: L.D.B.
RECOMMENDED:
CHECKED: R.A.S.
APPROVED:
DENVER, COLO. JAN. 2, 1932
222-D-22



REFERENCE NUMBERS

① Idaho Power Co.
② U.S. Reclamation Service.
③ Mountain States Power Co.
④ Portland Elec. Power Co.
⑤ Northwestern Elec. Co.
⑥ Pacific Power & Light Co.
⑦ Long-Bell Lumber Co.
⑧ Wash. Water Power Co.
⑨ Puget Sound Pow. & Lt. Co.
⑩ City of Seattle.
⑪ City of Tacoma.
⑫ Wash. Pulp & Paper Corp.
⑬ Federal Lt. & Traction Co.
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⑮ Chicago Mil. St. Paul & Pac. Ry.
⑯ Eastern Ore. Lt. & Pow. Co.
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(Figures indicate thousands of volts)		
Interconnections between different Companies.	44 / 44	44 / 44
Crossovers	44 / 44 / 44	44 / 44 / 44

DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
COLUMBIA BASIN PROJECT—WASHINGTON

EXISTING POWER SYSTEMS

DRAWN: ..... SUBMITTED: L.N. McCallon
TRACED: P.M.W. RECOMMENDED: J.L. Savage
CHECKED: C.R.D. APPROVED: G.S. Walther

DENVER, COLO., JAN. 2, 1932 | 222-D-23

THE COLUMBIA BASIN PROJECT

WEDNESDAY, JUNE 1, 1932

HOUSE OF REPRESENTATIVES,
COMMITTEE ON IRRIGATION AND RECLAMATION,
Washington, D. C.

The committee met pursuant to adjournment, at 10 o'clock a. m., in the committee room, No. 333 House Office Building, Hon. Robert S. Hall (chairman) presiding.

Present: Representatives Hall (chairman), Cross, Chavez, Miller, Overton, Martin, Smith, Leavitt, Swing, Arentz, Butler, and Loofbourow.

The CHAIRMAN. The committee will come to order, and we will resume the hearings on H. R. 7446. We have with us Congressman Hill and Congressman Horr, and I will ask Judge Hill to suggest the course of the hearing.

Mr. HILL. I want to introduce Mr. L. N. McClellan, chief electrical engineer for the Reclamation Service. I would like for Mr. McClellan to state to the committee something of his experience and training and work, as a kind of background for his testimony.

STATEMENT OF L. N. McCLELLAN, CHIEF ELECTRICAL ENGINEER, RECLAMATION SERVICE

Mr. MCCLELLAN. Mr. Chairman and members of the committee, as chief electrical engineer for the Reclamation Service, I am responsible for the construction designing of the various power plants and pumping plants constructed and operated by that bureau.

At the present time we are engaged on final designs for the Hoover power plant, also on the Madden Dam plant for the Panama Canal, and several small hydroelectrical plants.

Mr. HILL. How long have you been in the Reclamation Service?

Mr. MCCLELLAN. Twenty years.

Mr. HILL. Engaged in electrical work during all of that time?

Mr. MCCLELLAN. Yes.

Mr. HILL. How long have you been chief of the electrical engineering division?

Mr. MCCLELLAN. Since 1924.

Mr. HILL. Now, if you will just proceed and make a statement in your own way. You are familiar with this Columbia Basin project, and you have made some study of it?

Mr. MCCLELLAN. Yes.

Mr. HILL. Will you tell the committee the result of your studies?

Mr. MCCLELLAN. The general set-up on the Columbia River has been studied by the Corps of Engineers, and Major Butler has presented the general situation on the Upper Columbia River in a very complete and able manner. The Army studied the entire river and

considered all factors, flood control and navigation, power development and irrigation; and as the result of that study, they outline a comprehensive scheme for the development of the river as a whole.

The Columbia Basin project includes the dam and power development at Grand Coulee, one of the important units in the comprehensive plan.

The general situation on the upper Columbia River and the proposed Columbia Basin project has been very completely and very ably presented by Major Butler, and I will only attempt to outline the studies made by the Bureau of Reclamation of the proposed development and the financial operation of the project.

Briefly, the proposed project is a combined irrigation and power development which comprises a dam across the Columbia River at the upper end of the Grand Coulee and a power plant in connection therewith, which will have an ultimate installed capacity of 1,575,000 kilowatts or 2,100,000 horsepower, and a pumping plant to lift water from the lake above the Columbia River Dam to a reservoir to be created in the Grand Coulee and an irrigation system to distribute the water from this reservoir to the 1,200,000 acres of land to be irrigated in the Columbia Basin.

The Columbia River Dam, as contemplated, is a straight concrete dam of gravity section 4,100 feet in length at the crest and 450 feet in height above the foundations. It will raise the water surface 350 feet above the normal low-water surface of the river. It will contain something like 11,266,000 cubic yards of concrete, or over three times as much concrete as the Hoover Dam, and it will create a lake 150 miles in length and 120 square miles, or 77,000 acres, in area. In order to secure the maximum amount of firm power it is proposed to release stored water from the lake at times of low flow in the river. The top 80 feet, or a little over 5,000,000 acre-feet of storage, is to be used for this purpose, and the release of this stored water will not only increase the amount of firm power at the Grand Coulee development but will also increase the power output of all other power developments on the Columbia River below this point, such as the Rock Island plant. The dam will have an overflow spillway section 1,918 feet in length, designed to pass 1,000,000 second-feet, or over twice the maximum flood discharge of record.

The flow of the Columbia River at the dam site varies from a minimum of about 17,000 second-feet to a maximum of about 500,000 second-feet, with an average flow of 109,000 second-feet for the period of record, which is equivalent to an annual run-off of 79,000,000 acre-feet. Under present conditions, with no water being used for irrigation of the Columbia Basin, and utilizing the 5,000,000 acre-feet of active storage in the Columbia River Reservoir, the flow would be sufficient to maintain a continuous power output of 920,000 kilowatts.

This would be reduced to 800,000 kilowatts continuous firm power when the Columbia Basin project is fully developed, which will reduce the amount of water available for generation of power by the quantity required for irrigation purposes. The 800,000 kilowatts of continuous firm power is equivalent to 7,008,000,000 kilowatt-hours of energy per year, which is about 60 per cent more firm energy than will be available at the Hoover Dam. In addition to the firm power a large amount of secondary or seasonal power will be available during the

irrigation season and this power while of very small value for commercial purposes due to its intermittent nature is well suited to irrigation pumping and it is proposed to utilize something like 525,000 kilowatts of this seasonal power for pumping water for the irrigation of the Columbia Basin lands. The proposed power plant would have 15 main generating units of 105,000 kilowatts capacity each.

The pumping plant would consist of 20 motor-driven pumping units of 800 second-foot capacity each, or a total capacity of 16,000 second-feet. The pumps would deliver water into the upper end of the proposed reservoir to be created in the Grand Coulee by means of two dams, one at the upper end 92 feet in height and one at the lower end 97 feet in height. The reservoir would be 27 miles in length and it is proposed to fluctuate the water surface in this reservoir over a range of 15 feet so as to provide 329,000 acre-feet of active storage for regulatory purposes.

The irrigation project comprises 1,200,000 acres of irrigable land, of which 981,000 acres would be supplied directly from the Grand Coulee Reservoir and the remainder, or 219,000 acres, would be supplied by repumping to lands above the main canal system. It is proposed to line all canals of 100 second-feet capacity or more and some of the smaller canals where located in porous material would also be lined to minimize seepage losses.

The cost of the project is as follows:

Dam, $125,750,000; power plant, $42,616,000; interest during construction, $17,524,000; total, $185,890,000.

Irrigation development, $208,265,000, which equals $173.55 per acre. Added to the previous total of $185,890,000, this makes the total cost $394,155,000.

Initial irrigation development (150,000 acres), $34,939,000, which equals $232.92 per acre.

Maximum investment in dam and power plant, $209,000,000 in twelfth year.

Maximum investment in power and irrigation, $260,000,000, assuming irrigation development at rate of 20,000 acres per year.

Annual cost of irrigation, operation and maintenance, and depreciation, $3.19 per acre.

Assumed construction repayment $2 per acre per year, fourth to ninth years; $2.50 per acre ninth to fortieth years. Total repayment, $88 per acre.

During the early period of the operation of the power development, the revenues from the power will be inadequate to meet the expenses of the project; and it is estimated that, on the basis of absorbing the total amount of power in a 15-year period, the maximum investment in dam and power plant would reach a total of $209,000,000 before the revenues would be sufficient to wipe out the deficit incurred in the earlier period.

Mr. MILLER. Mr. McClellan, just to lay the foundation for other things—it might possibly be covered in your statement later—but I think you have reached the point where we might recapitulate just a little bit.

The total estimated cost of the dam and power plant and the irrigation project, all told, as I understand, is $394,000,000?

Mr. MCCLELLAN. Yes.

Mr. MILLER. Now, that money, of course, would necessarily have to be advanced by the Government from the reclamation fund?

Mr. MCCLELLAN. Not from the reclamation fund, but it would have to be advanced by some special act.

Mr. MILLER. It would be chargeable back to the reclamation fund?

Mr. MCCLELLAN. In the case of the Hoover project, there was a special fund, you recall, and the funds that were paid back were credited to that fund.

Mr. MILLER. Now, one question that Congress would probably be confronted with, and one that I am concerned with, is that this is a gigantic undertaking for the Government to enter into, and now what is your opinion as to the economic justification for the expenditure of that money at this time, or the authorization of that money at this time?

Mr. MCCLELLAN. I think that Doctor Mead proposed to go into that more in detail than I will be able to.

Mr. HILL. Mr. Miller, will you yield to me a moment there?

Mr. MILLER. Yes.

Mr. HILL. This $394,000,000 is not the total cost of both the power plant and dam; it is the dam and the power plant and the irrigation project. How much money will be required from the Government, or what will be the total amount of money required from the Government for this work?

Mr. MCCLELLAN. Assuming that the irrigation development takes place at the rate of 20,000 acres a year, the maximum investment in the combined power and irrigation development will be $260,000,000. The returns then on the power would reduce that investment, so it would never require a total of $394,000,000 to be advanced by the Treasury.

Mr. MILLER. What does your investigation reveal as to the ability of the Government to dispose of the current that it would produce at the power plant?

Mr. MCCLELLAN. Our studies indicate that the growth in the power market will be adequate to absorb this power in about 15 years.

Mr. MILLER. Is that area out there sufficiently developed—that is, taking its present condition; what is the condition of the development of the area as to the power that it could consume, say, upon the completion of the dam, within the next 3 or 4 or 5 years?

Mr. MCCLELLAN. Well, we assume that the growth in the load would, of course, be taken care of in the interim while the dam is under construction, and that the dam can successfully meet the additional requirements, the growth of the load, from then on; and for 15 years, the absorption period, it would be at the rate of a little over 50,000 kilowatts a year the market would have to absorb.

Mr. MILLER. That is the great trouble in building a hydroelectric plant, in financing a hydroelectric plant, the great trouble is to convince the men who are furnishing the money that you have market for the power.

Mr. MCCLELLAN. Roughly, we have about the same market in the Northwest, tributary to this development, that we have for the Hoover development.

Mr. MILLER. Now, if you do have a market for the power there, then there is some justification for the expenditure, for entering into the project; but unless you do have the market for it, I doubt the

advisability of entering into it. You have given that matter serious consideration, I take it?

Mr. McCLELLAN. Yes.

Mr. MILLER. That is the opinion of yourself and the opinion of your department?

Mr. McCLELLAN. Yes.

Mr. MILLER. That the power produced there can be marketed, and will be marketed?

Mr. McCLELLAN. Yes; when conditions become normal again.

Mr. MILLER. Well, of course, we know, or we are assuming, that we will return to normalcy—to use a worn-out phrase. That is, to my mind, the most important question in the whole matter.

Mr. McCLELLAN. I agree with you.

Mr. MILLER. Because we would not want to make the improvement out there and just let it stand there as a monument.

Mr. OVERTON. About how far from the power plant will the consumption of the electricity begin?

Mr. McCLELLAN. We have considered an area within a radius of 300 miles of the development as being a tributary market.

Mr. OVERTON. That is, within that zone, you can transmit the electrical energy economically?

Mr. McCLELLAN. Yes.

Mr. OVERTON. About how near to the dam does the construction begin? Where is the development in proximity to the dam?

Mr. McCLELLAN. Well, there would be a zone within a radius of 90 miles of the dam. The bulk of it, however, would be over on Puget Sound, which is about 170 miles away.

Mr. OVERTON. You would have to transmit the energy 90 miles?

Mr. McCLELLAN. That is the nearest market of any size; yes, sir.

Mr. OVERTON. That is the greatest market, or where is the greatest market?

Mr. McCLELLAN. The greatest market is over on Puget Sound, and that is about 170 miles, Seattle and Tacoma and——

Mr. OVERTON. Do you anticipate any development immediately surrounding the project itself?

Mr. McCLELLAN. No, sir.

The CHAIRMAN. I am going to ask Mr. Cross to preside until I can return. It is very necessary that the chairman go to the Indian Affairs Committee to make an important report.

Mr. SUMMERS. Mr. Chairman, though not a member of the committee, I would like to ask some questions.

Mr. CROSS. Very well; proceed, Judge.

Mr. SUMMERS. We are all very much interested in the amount of money that is going to be involved. Now, you have estimated, from first to last, I believe, about 10 years for the construction of the dam and the power plant.

Mr. McCLELLAN. Yes.

Mr. SUMMERS. And approximately what amount of money would be required from year to year? That, as a Member of Congress, concerns us very much.

Mr. McCLELLAN. The first year would require $7,600,000; the second year, $7,400,000; the third year, $7,400,000; the fourth year, $25,970,000; the fifth year, $31,000,000; the sixth year, $28,000,000; the seventh year, $29,300,000; the eighth year, $25,300,000. That

includes the major part of the dam proper, and from then on there is an annual appropriation of $10,000,000 for four years to carry on the completion of the power development.

Mr. SUMMERS. So that the largest amount required in any one year is $31,000,000, which would be in the fifth year of the construction?

Mr. MCCLELLAN. Yes.

Mr. SUMMERS. That, of course, is a rather different proposition from what it is to take over a $394,000,000 project. That contemplates an expenditure over how many years, would you say? That contemplates a complete development of the power and irrigation, and so on, over a period of something like 50 years, does it not?

Mr. MCCLELLAN. Sixty years, I think.

Mr. SUMMERS. Sixty years?

Mr. MCCLELLAN. Yes. The irrigation development will not be completed in the first 50 years, at the rate of 20,000 acres a year.

Mr. SUMMERS. So the total expenditure of $394,000,000 contemplates covering a period of 60 years, and during the first 30 years, according to the testimony of Major Butler, the dam and power plant, as I understand it, would be repaid from the returns. So never, at any time, would we have anything like the total amount invested; and it is not like a present-day proposition, but a long drawn-out farseeing proposition, that is being presented?

Mr. OVERTON. I understood from the testimony of Major Butler that the major expenditure would take place during the first 10-year period, in the construction of the power plant.

Mr. MCCLELLAN. The major part of it does, when the dam is completed and the initial installation in the power plant is completed.

Mr. OVERTON. How much would it be in the first 10 years; about how much would be expended?

Mr. MCCLELLAN. The first 10 years, the total would be—you are talking about power, the dam and power plant, not irrigation?

Mr. OVERTON. Yes.

Mr. SUMMERS. There would not be any irrigation in that period.

Mr. OVERTON. Let us take the power plant first, and the irrigation afterwards.

Mr. MCCLELLAN. In the tenth year we have—I am sorry I have not that total, that I have not got it totaled up that way. You will have to pardon me.

Mr. SUMMERS. If this will help. I have it here year by year, and I will submit it.

Mr. MCCLELLAN. About $164,000,000 in the tenth year.

Mr. OVERTON. Will you state approximately how much will be expended in the first 10 years on the reclamation part of it?

Mr. MCCLELLAN. About $18,000,000 will be the last three years for the 10-year period.

Mr. SUMMERS. But that would not be concurrent with that part of the construction?

Mr. MCCLELLAN. Not necessarily.

Mr. SUMMERS. Not at all; it could not be. It could not be, under the present bill, because you would have to have all of this before you would even start the irrigation.

Mr. MCCLELLAN. Yes.

Mr. OVERTON. I understand the irrigation cost would begin somewhere about the seventh year.

Mr. McCLELLAN. That is the way it is in the set-up, but that is not the way the bill provides. When we made our study, we were contemplating then having the initial development ready to operate when the dam is completed. The way the bill reads, no expenditure shall be made on the irrigation until after the dam and power plant are completed.

Mr. HILL. If I may interject here, under the redraft of the bill as submitted by the Reclamation Service and the Secretary of the Interior, and which we are asking the committee to adopt an amendment to the original bill, it would be probably not less than 15 years after the dam is completed before the reclamation work begins. That is made necessary because of the fact that we need the power revenues, the surplus power revenues, to help to carry the burden of the reclamation; and under the restrictions of the bill, it will be both legally and financially impossible to hurry the reclamation feature of the development, and that would necessitate its being postponed until at least about 15 years after the completion of the dam, so the power market could absorb the power and the maximum amount of revenue come from the power would be received, or would be coming into the Treasury.

And while I am talking, if I may say, as I understand Mr. McClellan, the project would be self-liquidating after the Government has advanced $260,000,000.

Now, if I may continue for a moment, referring to the question asked by Mr. Miller, would you say, Mr. McClellan, upon what basis, what percentage of increase in the power market, you base your estimate that this power will be consumed in 50 years?

Mr. McCLELLAN. I was going to come to that in just a moment.

Mr. MILLER. Mr. Hill, is the bill now the one that the committee—the one that you men who are vitally interested, are asking the committee to pass, H. R. 7746?

Mr. HILL. That is the bill, yes; but I may state in the record that the Secretary of the Interior transmitted to the committee a number of changes which he made or recommended to be made in that bill; and in order to get the matter in compact form, the bill was redrafted, and the redraft was submitted with this report, and it is upon that redraft that we are asking your consideration of the project.

Mr. MILLER. What is the number of the redraft?

Mr. HILL. The redraft has no number, but we ask that you substitute it by way of amendment for the original bill.

Mr. MILLER. Will the redraft carry that section 4 in the original bill, which is as follows:

SEC. 4. Before any money is appropriated for the construction of said dam in the Columbia River at Grand Coulee and/or power plant, and before any construction work thereon is done or contracted for, the Secretary of the Interior shall make provision for revenues by contract, in accordance with the provisions of this act, adequate in his judgment to insure payment of all expenses of operation and maintenance of said works incurred by the United States and for the repayment, within fifty years from the date of completion of said works, of all amounts advanced to the fund under subdivision (b) of section 2 for such works, except for the amount allocated to flood control, together with such interest thereon as is made reimbursable under this act.

Now, your redrafted bill will include that?

Mr. HILL. The redrafted bill carries that section as to the dam and power plant, and also as to reclamation.

Mr. MILLER. That being true, Mr. Hill, the most the Government will have invested in it will be its initial appropriation, will it not, in the beginning? In the beginning, the Government will make an initial advance?

Mr. HILL. Yes, sir; $260,000,000.

Mr. MILLER. That will not be available until the power contracts, as provided in this section, have been executed?

Mr. HILL. Can not be, either under the provision of the original bill, or under the redraft submitted by the Secretary of the Interior.

Mr. MCCLELLAN. Yes.

Mr. HILL. So that puts the Secretary of the Interior in this position: That he can not proceed with the construction until he has the contracts, which will reimburse the Government for the money paid?

Mr. MILLER. Does not that provision remove any objection that might be urged against the bill, or against the undertaking, if we have any faith at all in the ability and discretion of the Secretary of the Interior to administer it?

Mr. HILL. Yes; that is the purpose of putting it in. We wanted to be absolutely sure that the money would be available for paying this cost, and that safeguard is put in for that purpose.

Mr. MILLER. That seems to be a life saver in the bill.

Mr. SUMMERS. If you will pardon me, Mr. Miller, I think you will want to call attention to the fact that 4 per cent is allowed——

Mr. HILL. Four per cent is allowed on the construction of the dam and power plant. The new bill provides for reclamation, but the reclamation is the postponed part of the development.

Now, Judge Overton, I beg your pardon.

Mr. OVERTON. That is all right.

Mr. MILLER. Now, I would like to ask the witness a question: The estimate of the expenditures that you gave to the gentleman from Washington in reply to a question—is that based upon the cost, the estimated cost of the dam, or did you take into consideration——

Mr. MCCLELLAN. That is based on the estimated cost, with a margin to allow for some increases. In other words, the unit prices are actually higher than the unit prices on the Hoover Dam.

The market area in which the power from the proposed Columbia River development would have to be absorbed includes the area within a radius of approximately 300 miles of the dam site, which includes all of the State of Washington, the northern part of Oregon, the northern part of Idaho, and the western part of Montana. The most important power market in this territory is the Puget Sound district in western Washington, which is the logical market for a large part of the Columbia River power. The population of this area is approximately 3,000,000. In 1930 this territory used a little over 4,000,000,000 kilowatt-hours. During the 10-year period ending with 1930 the requirements for power increased at an average rate of 9.5 per cent per year compounded annually. In estimating the probable revenues from sale of power it was assumed that the future increase in power usage will be at a gradually decreasing rate of increase starting with 8 per cent in 1930 and decreasing to 4 per cent in 1960. This is somewhat more conservative than the assumptions used by the Army engineers, which were based on a rate of increase of 9.5 per cent in 1930 and decreasing to 4.75 per cent in 1960.

The Army engineers' estimate may be just as nearly right as ours. We simply found we could use a little more conservative figure and still have an economical project.

The installed generator capacity in the territory in which the power from the proposed Columbia River power plant would have to be absorbed now amounts to a little over 1,000,000 kilowatts, and if the load continues to increase in the next decade as it has in the past, but at a gradually reduced rate of increase, the installed capacity will have to be doubled by 1940 in order to supply the demand. This will absorb practically all of the output of the major hydroelectric developments, now under construction, by 1940.

If the power requirements continue to increase after 1940 at the assumed rate of increase, approximately 5,000,000 kilowatts of generating capacity would be required by 1955. The additional generating capacity that would have to be proivded during the 15-year period from 1940 to 1955 would amount to about 3,000,000 kilowatts, whereas the proposed installation at the Columbia River power plant is 1,500,000 kilowatts. In other words, the proposed installation of 1,500,000 kilowatts would take care of about half of the expected increase in power requirements during the 15-year absorption period. The other half of the expected increase would have to be supplied by other sources.

The total amount of energy generated in the territory in which the output of the proposed power plant would have to be utilized amounted to 4,000,000,000 kilowatt-hours in 1930. If the energy requirements continue to increase in the future as they have in the past 10 years but at a gradually decreasing rate of increase as assumed the total amount of energy generated will be approximately 8,000,000,000 kilowatt-hours in 1940 and over 20,000,000,000 kilowatt-hours in 1955. The annual energy requirements will have increased 12,000,000,000 kilowatt-hours in the 15 year period from 1940 to 1955 during which it is assumed that the energy output of the Columbia River power plant will be absorbed. The total amount of firm energy which this plant will make available will be 7,000,000,000 kilowatt-hours per year which amount will be sufficient to meet less than half the expected increase in the 15-year absorption period.

With proper cooperation on the part of the various power companies and municipalities which will have to be looked to to absorb the power output of the proposed Columbia River development no serious difficulty should arise in connection with the absorption of this large block of power within 15 years after the initial installation is completed The economic feasibility of the project is dependent to a very large degree on the rapidity of absorption of the power, particularly during the early years of operation when the revenues from power will be insufficient to meet the annual expense and deficits will be inevitable.

Mr. MILLER. It is not contemplated that the Government will own an interest or will be affected in regard to the transmission lines?

Mr. MCCLELLAN. No, sir.

Mr. MILLER. The idea is to deliver the power at the dam, and the distributing companies, the private companies, will build their own transmission lines?

Mr. MCCLELLAN. Yes.

Mr. MILLER. Now, how is the sale of power for domestic consumption regulated in Washington; are the rates regulated by some State commission?

Mr. McCLELLAN. So I understand; yes, sir.

Mr. MILLER. Or does each municipality regulate its own rate within its boundaries?

Mr. McCLELLAN. No, sir; there is a State commission that regulates the rates.

Mr. HILL. That is right.

Mr. MILLER. The State commission regulates the rates, so the rates are practically uniform the State over?

Mr. McCLELLAN. I do not know whether they are uniform or not. They are regulated with regard to local uses.

Mr. MILLER. Well, they would be kept under the same regulation?

Mr. McCLELLAN. Yes.

Mr. SUMMERS. In the same district——

Mr. McCLELLAN. Yes.

Mr. MILLER. The point I was getting at was this: Whether or not the power companies could afford to buy power from the Government at this time, whether or not they could afford—take the Puget Sound area there, for instance, whether or not they could afford to buy power at the dam and transmit it on their own transmission lines 170 miles, for instance, and still sell it to the consumer in that area there within the rates which the public utilities commission would approve?

Mr. McCLELLAN. Our studies indicate that they can buy this power cheaper than they can obtain it from any other source.

Mr. CROSS. Just one question: About how much per mile does it cost to build transmission lines?

Mr. McCLELLAN. About $12,000 a mile, for a single circuit. That is for 220,000 volts single circuit transmission wire.

Mr. CROSS. Should it be sufficient to carry enough electricity to Seattle to supply the city?

Mr. McCLELLAN. No, sir; they would have to have several circuits.

Mr. BUTLER. Do you not think it would be a wise provision, in the construction of any power development projects by the Government, to provide that the Government might have the right and authority to construct the transmission lines?

Mr. McCLELLAN. That might facilitate the securing of satisfactory contracts to have them.

Mr. BUTLER. And would not the people of the various communities being served be better protected that way, than to be at the mercy of the private power companies?

Mr. McCLELLAN. I do not know about that.

Mr. OVERTON. Not under public regulation.

Mr. SUMMERS. Might I say, at this point——

Mr. BUTLER. We have to protect the people sometimes from some of these Utilities Commissions.

Mr. SUMMERS. Is it your thought that the National Government should undertake the distribution of power throughout the municipalities?

Mr. BUTLER. Here is my position exactly, which I have stated before the Senate committees and the House committees, and publicly, and elsewhere: That I believe, when the Government constructs projects of this kind, that in the interest of the people and for the welfare of the people, there should be provision made so that

they could transmit it, if necessary, to protect those people for whom these projects are primarily built.

Mr. CROSS. The point I was getting at was this: You take these lines, practically 200 miles, and there would be an initial expense o $7,200,000; and whether the companies would be able to pay tha much money for it, is the question.

Mr. MCCLELLAN. They were in the case of the Hoover project The city of Los Angeles built several circuits from Hoover Dam ove to Los Angeles, and the Edison Co. will have to build at least tw circuits.

Mr. SUMMERS. The networks of wires that are now connected would they serve any purpose then?

Mr. MCCLELLAN. They would serve a small purpose of supplyin the local market, but we would still have to have the major trunl lines to carry the bulk of the power over to those centers.

Mr. SUMMERS. Of course, I think it might be interesting to cal attention to the fact that the Rock Island Dam, which is not very fa from this—that power has to be carried over to Seattle?

Mr. MCCLELLAN. Yes.

Mr. SUMMERS. That is a private concern, building the dam and all If I might be permitted to interrupt long enough in regard to thi other question that has come up, under a plan initiated two years ago it becomes possible for any county, or group of counties, to operate in the event the public utilities are charging excessive prices.

Mr. MILLER. Right there, Mr. Summers, is another argument fo inserting in this bill the provision suggested by Judge Butler, not fo the purpose of putting the Government in the power distributin business, but for the purpose of giving the Government a club to hol over the private power companies, to make them deal with thos municipalities on a live and let live basis; because, if they do not d it, then the Government can properly arrange it under the arrange ment you mention, and then build its transmission lines and delive the power at the edge of the corporation limits.

Mr. SUMMERS. I think that is provided in the bill.

Mr. CROSS. I think these matters should be discussed in executiv session.

Mr. MCCLELLAN. I am reading from the amended bill:

> The power plants so constructed, together with the transmission lines for th distribution of power therefrom, may be operated and maintained by the Secre tary of the Interior until transferred to the district or association.

By the time the initial installation at the proposed Columbia Rive Dam is placed in service most of the hydro developments now unde construction will be completed and the Columbia River power wil have to compete in price with power from other sources which wil be more costly due to their being located further from the market and consequently will involve more costly transmission facilities, an also with power produced in large modern steam generating station located near the load centers and using the cheapest fuel obtainable It seems probable that by the time power from the proposed Columbi River development becomes available the cost of steam power rathe than the cost of hydropower from other sources will determine th value of the power.

Studies of the cost of steam power assuming that the cost of fue oil delivered at the steam plant is $1 per barrel and assuming

load factor of 80 per cent, indicate that for a privately owned and operated steam plant the cost would be approximately 3.75 mills per kilowatt-hour while for a municipal steam plant the cost would amount to about 3.4 mills per kilowatt-hour for the same conditions.

It is assumed that the power would be sold at wholesale at the power plant similar to the arrangement under which the Boulder Canyon power was sold. In order to arrive at the value of energy at the power plant it is necessary to deduct from the cost of competitive steam power the cost of transmitting the energy from the Columbia River to the load centers. The distance from the Grand Coulee to Puget Sound load centers is approximately 170 miles and it is estimated that the cost of transmission including the cost of steam standby to protect the load against transmission line outages, would amount to 0.7 mill per kilowatt-hour for the privately owned and operated transmission system and about 0.54 mill per kilowatt-hour for a municipally owned and operated transmission system. The value of energy at the power plant would then amount to about 3 mills per kilowatt-hour if purchased by a private company, or 2.9 mills per kilowatt-hour if purchased by a municipality, both on the assumption of 80 per cent load factor and fuel oil at $1 per barrel.

Some margin should be allowed between the cost of substitute power from other sources and the price of Columbia River power so as to induce the various power companies and municipalities to utilize the Columbia River power in preference to power from other sources, and to expedite the absorption of the Columbia River power as rapidly as possible which is a very important factor in the financial success of the development. Based on the cost of equivalent substitute power obtained from steam-electric generating stations located at load centers and with fuel oil at $1 per barrel, the value of firm energy at the Columbia River power plant would be somewhere between 2.5 and 3.6 mills per kilowatt-hour, depending on load factor and whether public or private agencies purchase the power. A price of 2.25 mills per kilowatt hour should be sufficiently attractive to induce the power companies and municipalities to purchase energy in lieu of constructing additional power plants of their own and to insure that the Columbia River power will be absorbed as rapidly as the growth of load will permit.

Studies of the financial operation of the proposed Columbia River development based on the assumptions that 800,000 kilowatts of continuous firm power is absorbed in 15 years, which corresponds to a rate of 53,300 kilowatts or 467,000,000 kilowatt-hours per year; that the firm energy is sold at 2.25 mills per kilowatt-hour; that secondary power is sold for irrigation pumping purposes at the rate of $1 per acre per year, which is equivalent to approximately 0.5 mill per kilowatt-hour; that irrigation development takes place at the rate of 20,000 acres per year; and that the power plant is operated and maintained by the Government, indicate that the revenue would be sufficient to repay the entire cost of the Columbia River dam and power plant with interest at 4 per cent per annum within 50 years, in addition to providing for operation, maintanance, and depreciation of the dam and power plant and also provide a surplus of approximately $144,000,000 which would be available for repayment of the cost of the irrigation development.

I have a chart here showing, graphically, the financial operation of the project, which I would like to have inserted in the record.

Mr. CROSS. There is one question in my mind, that I would like to ask: Assuming that the land that would be reclaimed is fertile land, is it land upon which the alkali would rise when irrigated?

Mr. MCCLELLAN. Major Butler, I wonder if I may refer that question to you, please?

Major BUTLER. I would be compelled to state yes, in many cases. However, in our report, we made a classification of these lands, and we threw out all of this land that would not be satisfactory in that respect, as far as our estimates go.

Mr. MCCLELLAN. Major, if you will pardon me, I do not know how far you have investigated that, but in the early construction of irrigation projects in the West, much difficulty was encountered on account of alkali rising, but in those cases due care had not been given to drainage, and now, under the present methods of construction, when the proper drainage is arranged for, there is no difficulty about alkali.

Major BUTLER. I will state further that we do make provision for the item of drainage.

Mr. MILLER. I want to ask Mr. McClellan another question: I understood that the Government could offer this power at its dam at 2¼ mills per kilowatt-hour?

Mr. MCCLELLAN. That is what we thought the power would be worth, based on the cost of competitive power.

Mr. MILLER. I understand that does not mean that it would cost the Government that much to produce it?

Mr. MCCLELLAN. No, sir.

Mr. MILLER. But it means that the price of 2¼ mills is fixed, based upon the price of other power, of competitive power that might be produced?

Mr. MCCLELLAN. Yes, sir.

Mr. MILLER. And be available to prospective purchasers from the Government? That is the point.

Mr. MCCLELLAN. Yes.

Mr. MILLER. Now, then, as a matter of fact, in order to meet the competition, if it is necessary, the Government could sell that power at a rate produced even below 2¼ mills?

Mr. MCCLELLAN. Yes, sir.

Mr. MILLER. Considerably below that, as a matter of fact, could it not?

Mr. MCCLELLAN. Yes; but of course, that would curtail the amount of money that would be available for subsidizing the irrigation part of the project.

Mr. MILLER. Yes; but just looking at it as a power development proposition, because that really is the main consderation to be given, or the present consideration to be given to it, what would then be the cost to the Government to produce that power and deliver it at the switch of the transmission lines at the plant?

Mr. MCCLELLAN. You mean if we had all of the plant load outright at the beginning, and did not have any deficit to take care of?

Mr. MILLER Yes.

Mr. MCCLELLAN. I think Major Butler's figure indicated about 1.14 mills.

Major BUTLER. We figured about 1.14 mills, under certain conditions.

Mr. MILLER. The point I was trying to get at is this: So that you could not be mistaken about the price of 2¼ mills—you are absolutely safe in figuring that selling price at the plant at 2¼ mills?

Major BUTLER. In our financial set-up, I will state that we used 2¼ mills.

Mr. MILLER. But the actual cost would be less than that?

Major BUTLER. Yes.

Mr. CROSS. Well, now, in the first instance, I do not know what period of time you mentioned, or if you indicated, but in my opinion it ought not to be too long; because, in the first instance, especially, to build these lines and transport the electricity, it would have to be at a lower rate, in the beginning, because you would have to induce them to build them, because they have already got their plants that are operated by steam, and would have to give those up.

As soon as those plants became useless, and after they got the lines up, you could make a much better deal with them than you could in the first instance, because they would have to abandon their plans and abandon the lines; and if they do abandon those plants, in some years they would be worthless, and they would be kind of Jonahs.

Mr. MCCLELLAN. Well, the way it would work, Mr. Congressman, is that they would have a certain amount of steam plants when the project was completed, but those would become stand-by steam plants, to back up the transmission lines. That is necessary, in any event, to take care of the outages, and they would have to have some steam plants to take care of the load, if the transmission lines failed. So that those steam plants, which would be carried along in the interim, while the dams are being built, would later become stand-by for the major transmission set-up.

Mr. HILL. Pardon me, Mr. Chairman, but may I ask a question?

The CHAIRMAN. Yes.

Mr. HILL. In your estimate as to the time for absorbing this power, you do not, as I understand, take into consideration the abandonment of the existing power plants, or of the discontinuance of the power generated by such plants.

Mr. MCCLELLAN. No, sir.

Mr. HILL. That is simply to be used to fill in, or take care of the increase in the demand for power?

Mr. MCCLELLAN. That is right.

Mr. HILL. And the others' plants may continue to operate? That is the basis upon which you have figured the 15-year period for absorbing the power? Is that correct?

Mr. MCCLELLAN. Yes.

The CHAIRMAN. That is all, Mr. McClellan.

Mr. HILL. I would ask that Mr. McClellan offer this chart in connection with his statement here, as a part of the record.

The CHAIRMAN. Yes.

Mr. MCCLELLAN. Mr. Chairman, that same chart is in the record.

Mr. HILL. It is not necessary to put it in here, then, again.

The CHAIRMAN. Have you someone else that you want to introduce?

Mr. HILL. Mr. O'Sullivan, are you ready to go on this morning? Or are you ready to go on, Mr. Gill? How long before Doctor Mead will be here?

Mr. GILL. I think about 10 minutes.

Mr. HILL. Maybe Doctor Summers would like to make a statement at this time.

Mr. SUMMERS. I did not expect to at this time.

Mr. HILL. Representative Horr, would you like to make a statement now?

Mr. HORR. I would rather make it after you get through with the others.

Mr. HILL. Commissioner Mead will be here in a short time. I would like to put on Mr. Gill at this point. However, we will take Mr. O'Sullivan, while Mr. Gill is finding his documents.

Mr. O'Sullivan lives in the heart of this proposed reclamation project, and he represents here, voluntarily, an association known as the Columbia River Development League, which is organized for the purpose of encouraging and promoting this movement. Mr. O'Sullivan has spent 10 years or more in very intensive study of both the power development and the reclamation feature of the development; he is, himself, a construction engineer. His other experiences may be stated by Mr. O'Sullivan, as to his background and qualifications for what he may say.

Mr. GILL. His phase of the testimony will cover largely the reclamation and irrigation part of the subject?

Mr. HILL. Both.

The CHAIRMAN. We will now hear Mr. O'Sullivan.

STATEMENT OF JAMES O'SULLIVAN, EPHRATA, GRANT COUNTY, WASH.

Mr. O'SULLIVAN. Mr. Chairman and members of the committee, the league I represent was formed by the farmers and towns people living on the Columbia Basin project and surrounding areas. These people have made great sacrifices for many years in order to further this great project. For the last 12 years I have made an intensive study of the Grand Coulee development, and during the last four years of this time have spent all of my time on it, studying all phases of the project, including the engineering reports, the reclamation features, the power market, agricultural markets, and so forth. I have also made a study in the field of the wonderful reclamation and power developments in the State of California and have prepared briefs on the power and agricultural market in connection with the Columbia Basin project and on the utilization of power to make feasible the great developments of California. For 20 years I was engaged as a general contractor handling different classes of construction, including power plants, and so forth.

The statement I have prepared, in part, covers information already so ably given to you by Major Butler and Engineer McClellan. In order to save the time of this committee, I would like to have that part of the statement printed in the record without being read to the committee.

Mr. MILLER. That is a good suggestion, because we will have to have the record of the hearings, anyway.

Mr. HILL. Yes; it may be inserted in the record.

(The matter above referred to is here printed in full as follows:)

THE COLUMBIA BASIN PROJECT—FACTS BASED UPON ARMY AND RECLAMATION REPORTS AND OFFICIAL STATISTICS

(Prepared by James O'Sullivan)

Columbia River Dam at head of Grand Coulee, State of Washington.—The outstanding fact is that this great dam and power plant will be the commanding development in the comprehensive plans that Army engineers, after a most thorough and exhaustive survey, have recommended for the maximum ulitization of the Columbia, the greatest power stream in America. If no reclamation whatever resulted from its construction, it would still be absolutely essential to the full development of the second largest river, in volume of flow, in the United States. The vast storage created by this dam for river regulation will double the prime power output of every dam on the river from the boundary to the Snake and add better than 50 per cent to the power of every dam below the Snake, all of which dams are included in the comprehensive plans.

This dam will also furnish the largest block of cheap power in the United States. Compared to these two major results, the reclamation of the 1,200,000 acres in the Columbia Basin project, while of great ultimate value, is but an incidental purpose. Opposition to this masterful development because it makes possible in the years to come the gradual reclamation of the lands mentioned is merely opposition to the full utilization of the greatest power stream in America.

THE COMPREHENSIVE PLANS

The Columbia River.—Length, 1,210 miles. Drop or fall in United States, 1,284 feet. Maximum flow at The Dalles in 1894, 1,170,000 second-feet; at the Grand Coulee dam site, 725,000 second-feet. The annual run-off of this river is ten times that of the Colorado at Hoover Dam.

Recommended plan of development.—The eight dams recommended by the United States Army district and division engineers, Seattle and Portland, will develop 92.3 per cent of the total drop or head in the United States making possible the development of 41,064,000,000 kilowatt-hours, or one-third the total electric power produced in the United States in 1930, at an estimated cost, including carrying charges, of $757,583,373. The Chief Engineer of the Army has recommended that Congress adopt a comprehensive plan for Columbia River development embracing 10 dams as follows: Grand Coulee, Foster Creek, Chelan, Rocky Reach, Rock Island Rapids (constructed), Priest Rapids, Umatilla Rapids, John Day Rapids, The Dalles and Warrendale. The cost of the 10 dams, including carrying charges during construction, is estimated at about $675,000,000, and it is estimated that the 10 dams would have an installed capacity of about 8,000,000 kilowatts or about 10,700,000 horsepower.

Storage.—The Army plans contemplate storage primarily to regulate the flow of the river for power purposes and incidentally for navigation, reclamation, and to some extent, for flood control. This storage impounds the floods in summer and releases them in winter, during the period of low water, thereby greatly increasing the prime or commercial power. The total useful storage available will be 17,764,000 acre-feet, at least under the plans submitted by the local Army officers, of which 5,028,000 acre-feet will be created by the construction of the dam at the head of the Grand Coulee and 5,974,000 acre-feet by storage works in the lakes that feed the Columbia above the site of the dam at the head of the Grand Coulee. Thus 10,002,000 acre-feet will be available for power development at every dam site in the comprehensive plan. The storage at the Grand Coulee site alone increases the minimum flow at that site from 17,000 second-feet to 40,400 and the storage above the site will increase the minimum flow at the site from 17,000 to 32,900 second-feet. As far as the writer can ascertain, all of this storage has not been taken into account in estimating the potential power of the lower Columbia.

THE COLUMBIA BASIN PROJECT

The new plan recommended by both the Army and reclamation engineers secures it's water supply for reclamation from the Columbia River at the Grand Coulee dam site instead of from the Pend Oreille River at Albany Falls, Idaho. It embraces 1,200,000 acres; has a main canal but 15 miles long; has no interstate

or international complications; will develop 1,575,000 installed kilowatts or 2,100,000 electric horsepower, and profits by delayed reclamation. Both the Army and reclamation engineers pronounce this plan as economic. The old plan, which is now discarded by the Army and reclamation engineers as uneconomic, embraced 1,883,000 acres; had a main canal 130 miles long; required the consent of Idaho and Montana for necessary storage; had no appreciable power resources; and required rapid reclamation and early settlement in order to finance it.

The dam at head of Grand Coulee.—Excellent granite foundations but 60 feet below low water and excellent granite sidewalls. Clay, excellent for cofferdam work, on top of bedrock. Construction material at or near the site. Will be 370 feet high above low water (elevation 933), and 4,290 feet long on the crest. Will contain about 11,000,000 cubic yards of concrete and will form a lake in Columbia 151 miles long with a water surface (elevation 1,287.6 feet) area of 74,900 acres.

Power plant.—Power head, full reservoir, 354.6 feet. Installed capacity 2,100,000 horsepower. Power output, annual, about 8,200,000,000 kilowatt-hours per Army report; 7,000,000,000 per United States Reclamation report. About 660,000 secondary (flood water) horsepower (no primary) will be used for pumping 16,000 cubic feet of water per second from the lake formed by the dam at the head of Grand Coulee into the proposed Grand Coulee Reservoir, a height varying from 266 to 366 feet, depending on the water surface of the Columbia Lake and the Grand Coulee Reservoir.

Pumping plant.—Located at the edge of lake formed by the dam, at the intersection of the Grand Coulee with the river. Under Army plans will consist of ten 1,600 second-foot pumps; under the plans of the reclamation service will consist of 20 single-stage, 800 second-foot pumps, each driven by a 33,000 horsepower motor. These will be housed in a water-tight pumping station, 100 feet by 640 feet, the station to be water-tight to permit the utilization of the top 80 feet of the lake in the Columbia for storage purposes.

Grand Coulee Reservoir.—An artificial lake in the Grand Coulee, 23 or 27 miles long (depending upon the final location of the lower storage dam) and from 1 to 2 miles wide which will be made possible by the construction of two, low earth dams. The elevation (full) of this lake will be 1,570 feet. By utilizing the top 15⅞ feet, there will be 329,000 acre-feet of storage available for reclamation.

Main canal.—This will be from 11 to 15 miles long, depending upon the length of the Grand Coulee Lake or reservoir. At the end of the main canal, the distributing canals will commence, one running westward and the other southeasterly.

Cost.—The cost of the dam and complete power plant in the Columbia at the head of the Grand Coulee will be, including carrying charges, as follows: Per Army report, $171,187,000; per reclamation report, $185,890,000.

Irrigation project.—Actual acreage 1,199,430. Net acreage for cultivation, about 905,500 acres.

Cost of reclamation.—Construction cost of reclamation, including pumping plant, as follows:

	Total	Acre
United States Reclamation report, without interest	$208,265,000	$173.55
United States Army report, without interest	180,825,330	150.76
United States Army report, with interest	221,722,180	184.86

Total cost, power development, and reclamation.—Per United States reclamation report, $394,155,000; per Army report, with interest on reclamation, $392,909,180; without interest on reclamation, $352,012,330.

Actual investment required.—Until the time that the power revenues will be able to carry the load, the total investment required will be $260,000,000, per United States reclamation report. This sum will be the total investment that the Federal Government will have to make in the entire project.

Market for power.—The local district and division Army engineers and the engineers of the United States Reclamation Service, after a most thorough and exhaustive study, find that the power market in the Northwest, which includes Washington, the northern one-half of Oregon, northern Idaho and that part of northwestern Montana served by the Thompson Fall's plant, will be able to

absorb all of the power of the dam at the head of the Grand Coulee within 15 years after the assumed date of completion of the dam and power plant, viz, 1940, even if but one-half of that power market is served by the Grand Coulee site. These engineers also find that present electric development or that planned for the early future in that market area will all be loaded to capacity by 1940. The estimates of these engineers were based upon the rate of growth in the use of power in that market area in the past 25 years which was at the rate of 9.5 per cent compounded annually. The Army engineers estimated that the rate of growth for the future would gradually decline until it reached 4.75 per cent by 1960 and zero by 1990. The United States reclamation engineers assumed that the rate of growth would begin at 8 per cent in 1930 and decline to 4 per cent by 1960. The Army engineers made the following estimate of the power production required in the territory tributary to the dam at the head of Grand Coulee:

Year	Kilowatt-hours	Average	Installed capacity
		Kilowatts	*Kilowatts*
1930	4,041,000,000	461,333	1,145,135
1935	6,480,000,000	740,000	1,480,000
1940	10,230,000,000	1,168,000	2,336,000
1945	15,650,000,000	1,787,000	3,547,000
1950	22,930,000,000	2,617,000	5,234,000
1955	31,830,000,000	3,633,000	7,267,000
1960	41,630,000,000	4,752,000	9,504,000

Cost of power.—Both the Army and reclamation reports show that Grand Coulee power can be delivered to Puget Sound cheaper than the cost of generating steam electric power with oil costing $1 per barrel, the prevailing price at Puget Sound. It is generally conceded that this power, for its bulk, will be the cheapest, in production costs, in the United States, even cheaper than at Niagara Falls. Private enterprise, paying 6 per cent for its money, can not produce power in the Northwest market area, or anywhere else in the United States, as cheap as it can be produced at the Grand Coulee. These statements are sustained by Maj. John S. Butler and Hugh L. Cooper.

Net cost of reclamation.—The net cost of reclamation to the settler or farmer will be $88 an acre per United States Reclamation report; if interest is included in the cost of reclamation, the net cost, according to the Army report, will not exceed $120 an acre. These net costs are arrived at by applying a part of the power revenues in payment of a part of the cost of reclamation. The reclamation engineers find that the power revenues will pay for the dam and power plant, with 4 per cent interest, in 50 years, together with the cost of operation, maintainence and depreciation thereof, and leave a surplus of $144,000,000 to apply on the cost of reclamation, assuming that the power is sold at 2.25 mills per kilowatt-hour. The Army engineers find that if the power is sold at 2 mills, net, or 2.1 mills, gross, per kilowatt-hour at the switchboard, it will pay for the dam and power plant, with 4 per cent interest, in 30 years after the date of the first expenditure and will, at the end of 40 years provide a surplus of $140,000,000, and if interest at 4 per cent is allowed on the surpluses as they occur, the surplus at the end of 40 years will be $168,070,000. The Army estimates of power output at Grand Coulee are slightly higher than those of the Reclamation Service.

Net costs reduced under act 1927.—The net costs above stated are much less than those obtaining on some successful Federal reclamation projects in the State of Washington and can be further reduced by the taxation of other property within the reclamation district. Under the provisions of the special act of 1927, State of Washington, the Army report shows that the values of assessable property within the Columbia Basin area will be increased $217,000,000 by the construction of the project.

Annual cost of operation, maintenance, and depreciation.—Per United States Reclamation report, $3.19 an acre; per United States Army report, $4 an acre. These costs include a charge of $1 an acre for the power for pumping, per United States Reclamation report, and $1.20 an acre per the Army report.

Annual construction repayment required.—Per United States Reclamation report, $2 an acre for first four years and $2.50 an acre for following 32 years:

"In the financial study (Table No. 6) to determine how the investment is to be repaid, it has been estimated that the land, beginning four years after the

completion of the Columbia River Dam and power plant, and four years after the beginning of irrigation of each completed division will pay $2 per acre per year for four years and thereafter pay $2.50 per year for 32 years. In this manner each division or block of land irrigated will pay out in 40 years an amount which, when added to the proportional power surplus, will liquidate its proportionate share of the irrigation investment." (See report Chief Engineer United States Reclamation Service, dated January 7, 1932, p. 74.)

The Army report assumes that the annual construction repayment required will be $3 an acre over a period of 40 years. Since the Army costs includes interest on reclamation during construction and settlement and until final payment by the settler, the Army estimate of the net cost to the settler if no interest is charged on reclamation, would approximate that of the Reclamation Service.

Annual charges land can stand.—Per Army report, $6 an acre; per United States Reclamation report, $5.25 an acre. According to the latter report, if depreciation is excluded, the total annual charges will be $4.59 and $5.09 per acre; if it is included in operation and maintainance, they will be $5.19 and $5.69, the first figures being for the first four years and the latter figures being for the following 32 years. These charges will be reduced considerably by the taxation of benefited property within the irrigation districts.

Mr. O'SULLIVAN. The assumption, in certain quarters, that the construction of the Columbia Basin project will promptly throw into production 1,200,000 acres of new land is indefensible. This is both physically and financially impossible. Even if authorization could be secured to-day, it would take several years to dispose of the power, a condition precedent under the bill to any appropriations for construction. It would then take another 10 years to complete plans for and to construct the dam and power plant. There can be no reclamation until the dam and power plant are built. The earliest date, from a physical standpoint, that water could be put on any of the land would be 1945, and this assumes that the project will be authorized to-day.

But there is another factor that probably will delay reclamation until as late as 1950 or 1955 and that is financial. The reports show that it will take 15 years, after completion of the dam and power plant, for the market to absorb Grand Coulee power. In his letter, dated March 19, 1932, to the Chief of Army Engineers, Dr. Elwood Mead, Commissioner of Reclamation, referring to the project, says:

> It will require at least 10 years after the works are authorized to build the dam and the power plant and another 10 or 15 years to absorb the power thus made available. These things must precede the large expenditure to build the works required for irrigation.

The power must be well on toward absorption and returning maximum revenue before it would be safe or financially feasible to start any reclamation. If the power revenues are diverted too soon from paying for the dam and power plant toward paying for reclamation, the interest charges on the dam and power plant will be greatly increased. The Army engineers find that the longer reclamation is deferred the lower the cost per acre will be to the farmer. If reclamation were deferred to 30 years after the first expenditures on the dam and power plant are made, the power revenues would not only finance the construction of the reclamation works but would be sufficient to pay for the entire cost thereof. Even after reclamation is once started, the economics of the project demand that it proceed at a slow rate each year. Accordingly, the reclamation plans do not contemplate the reclamation of more than 20,000 acres per year. If reclamation should start in 1950 or 1955, it would be the year, 2,000 before it would be completed.

Crops to be grown on the project: The Army experts estimate that market conditions will require the following crops to be raised on the project: Hay, including alfalfa, and so forth, 539,125 acres; small grain, including corn, 213,750 acres; vegetables, including potatoes, 59,375 acres; beans and peas, 71,250 acres; fruit, 19,000 acres; total 902,500 acres. It is expected that most of this production will be fed to beef and dairy cattle, hogs, sheep and lambs on the project farms.

Estimated returns per acre: Army experts estimate that the gross return, per acre, will be valued at $54, which is from two to two and one-half times the average return per acre from farms in the United States. In 1911 the Bureau of Soils, Department of Agriculture, United States Government, made a soil and climatic survey of about 500,000 acres of land within the Columbia Basin project and reported that the soil was extremely rich, that the area possessed one of the best agricultural climates on the American continent, and that if the land were irrigated, it would be very productive.

Future markets for Columbia Basin products: The Army population experts estimate that by 1960 the increase in the population of Idaho, Oregon, and Washington will be 1,438,000 and that this increased population, would require the entire agricultural production of the Columbia Basin project. The report of the Army states that the undertaking of the project will be necessary to maintain this rate of growth. In the past decade, while the population of the United States was increasing 16.1 per cent, the population of the 11 far Western States increased 35 per cent; that of the seven States west of the Rockies increased 41 per cent, and that of California, Oregon, and Washington increased 47 per cent. Our most noted population expert, Mr. F. K. Whelpton, Miami University, estimates that by 1960 the population of the United States will be 162,670,000 or an increase of 39,894,952 over the population of 1930. This would represent an addition of one-third to our present population. The present area of our farm land, in crop and in pasture, is between three hundred and thirty and four hundred million acres. In 1923 our Department of Agriculture predicted that we would need 40,000,000 additional acres of cultivated land in the United States by 1950, and that we would then have a population of 150,000,000.

The 11 far Western States are to-day deficient in producing staple feed and food products. The population of the far West, consisting of the States of Washington, Idaho, Oregon, California, Utah, Arizona, Nevada, Montana, Wyoming, Colorado, and New Mexico, in 1930 was 9.6 per cent of the population of the United States. In the same year the population of the 12 North Central or Middle Western States, consisting of Minnesota, Wisconsin, Michigan, Ohio, Illinois, Indiana, North and South Dakota, Kansas, Nebraska, Missouri, and Iowa was 31.2 per cent of the population of the United States. According to the yearbook of agriculture for 1931, the 11 far Western States, in the year ending June 30, 1930, produced, in value but 6 per cent of the rye, 3 per cent of the corn, 4 per cent of the oats, 4 per cent of the hogs, 9.17 per cent of the milk, and 9.4 per cent of the eggs then produced on all of the farms of the United States, while the 12 Middle Western States then produced, in value, of the total farm production of the United States, 80 per cent of the rye, 73 per cent of the corn, 80 per cent of the oats, 79 per cent of the

hogs, 52 per cent of the milk and, 51 per cent of the eggs. California, Oregon, and Washington are to-day shipping in large quantities of hogs, canned meats, and considerable dairy products. The far Western States produce surpluses of lambs, sheep, wool, wheat, alfalfa, barley, potatoes, truck crops, cattle, calves, and fruit, but with the exception of fruit, truck crops, sheep, lamb, wool, and potatoes, these surpluses are not out of proportion with the surpluses produced by the Middle Western States in the same and other farm products. Since the far Western States feed their alfalfa and barley to livestock, they can not be considered surpluses except as reflected in the figures of livestock production. The United States is importing large quantities of cattle and canned, chilled, and frozen beef and veal. It is to-day and for some years has imported about one-third of its wool supply. While the far Western States are producing 21 per cent of the wheat as compared to 64 per cent for the Middle West, its wheat is mainly exported. The surpluses in fruit and truck crops are produced mainly in California, and the West can not live on fruit and truck crops alone.

Mr. HILL. Mr. Chairman, Commissioner Mead is here, and I want to withdraw the present witness and introduce Doctor Mead. I just want to accommodate Doctor Mead.

Mr. Chairman, I present Dr. Elwood Mead, Commissioner of Reclamation. Of course, he needs no introduction. He knows probably more about this matter than anyone else.

He had better state, for the record, what position he occupies and his years of service, and so on.

STATEMENT OF DR. ELWOOD MEAD, COMMISSIONER OF RECLAMATION

Doctor MEAD. Mr. Chairman, I am Commissioner of Reclamation and have charge of the investigation and construction and operation of reclamation works carried out by the Federal Government, and that work is spread over the entire western one-third of the country, known as the arid region.

Mr. HILL. All right, Doctor, just go ahead and give us your statement.

Doctor MEAD. I wish to present my reasons for the belief that this bill is a sound measure in every way. I think it is a bill that ought to be passed now, not because of a belief that the time is here for beginning construction—I do not believe that—but because preceding construction there is need for wise planning and the working out of a program by which an enterprise of the magnitude of this will render the greatest possible benefit to the State and to the Nation. In other words, a measure like this is needed for the inauguration of a plan for the best use of the most important resources of the Northwest, that is, the waste waters of its rivers. In the arid region water is a resource that is more valuable than land, more valuable than any other of nature's gifts. The Columbia is the greatest river of the arid region, almost equal to all of the others put together. The use of it, if wisely planned, means not local advantages alone, it means national advantages, as well.

Now, those beliefs are not of this year alone. They are based on the experience of the last eight years. When I became Commissioner of

Reclamation in 1924, the benefit to the cities of Spokane, Seattle, Tacoma, and in a lesser degree, Portland, and many smaller cities, was apparent to any student of conditions which had created those cities and of the needs for their future growth.

Spokane became a city, with the utilization of the timber lands around it, with the discovery of the Couer D'Alene mines, with the development of the great grain growing area. Because of these the city grew rapidly and became a very beautiful place and had a high measure of prosperity. In time the timber was cut off, grain growing ceased to be profitable, miners were worked out and the resources on which prosperity rested were no longer an adequate basis for future development.

Now, in a lesser degree the same conditions affect the growth of Seattle and Tacoma. When I first went to these cities, they thought utilizing the water of the Columbia was a problem of eastern Washington and of the city of Spokane; because they had been built up on their Alaskan trade, on the larger timber areas, on the development of the mines, and local agriculture they did not feel that the Columbia River, with its great water supply, of 140,000,000 acre feet, a year, was a practical concern of theirs.

But I was there last year and was called into a conference by the Seattle Chamber of Commerce, and they said, "This city and all of the cities of this region now have come to the point where water is the key to our future growth, and where, without its development, our growth is going to cease." They said, "We wish to show you a series of tables and graphs showing what has built up Seattle in the past and what is happening now." For years the high spots of this growth was the Alaskan trade, exports of timber and grain; but in recent years the mines have fallen off, exports of grain and timber are smaller, but the commercial shipments out of Seattle into the different markets of the world from the orchards of Yakima and the Wenatchee Valleys have continuously increased.

Three representatives of transcontinental railroads told me that the one bright spot on all of their three lines, reaching from Chicago to the west coast, were the increase in shipments of irrigated products from the valleys of the State of Washington. The remarkable thing is the extension of that export trade across the Pacific. The statement is made that there is not a city of 100,000 people in the world where you can not buy an irrigated apple from the State of Washington. Certainly anyone who looks at the records of exports from Seattle would see that irrigated fruits is one of our products for which there is a world demand which it is to the national advantage to supply.

Now, we have, as I see it, the greatest opportunity for power development that has yet been proposed in the United States. We have 1,200,000 acres of fertile land, the best undeveloped irrigation area on this continent, probably the best single area, developed or undeveloped, on the continent; but the utilization of those two resources, power and agriculture, are difficult. It might be spoiled by lack of adequate preparation and lack of adequate planning.

I have a statement that shows the investigations that have been carried out by our bureau, which extend back to the very beginning of the reclamation service in 1903; and without taking the time to read it, or discuss it, I would like to file it, to save time, as part of the record.

The CHAIRMAN. You desire that as a portion of your testimony?
Doctor MEAD. Yes; as a part of my testimony.
The CHAIRMAN. It may be inserted in the record.
(The statement referred to is here printed in full as follows:)

COLUMBIA BASIN PROJECT, WASHINGTON—INVESTIGATIONS BY BUREAU OF RECLAMATION

The following statement gives a record of investigatinos and published reports of the Bureau of Reclamation on the Columbia River, Priest Rapids, Big Bend, and Palouse projects, all of which are embraced within the limits of the Columbia Basin project:

	Pages	Report	Author
Annual Report No. 2, 1902-3	440-441	Snake and Columbia Rivers.	J. C. Camp.
	489-491	Big Bend project	T. A. Noble.
Annual Report No. 3, 1903-4	600-605	Palouse project	Do.
	609-611	Priest Rapids project	Do.
Annual Report No. 4, 1904-5	342-345	do	L. J. Charles.
	345	Palouse project	C. Anderson.
		Board report, April, 1905	A. P. Davis, A. J. Wiley, D. C. Henny, and T. A. Noble.
Annual Report No. 5, 1905-6	292	Palouse project	
	292-293	Priest Rapids project	

Expenditures to June 30, 1906, $82,036.57.

Further investigations were discontinued until 1913 when the Legislature of the State of Oregon appropriated $15,000 for the investigation of the engineering and commercial feasibility of a power site on the Columbia River, at Five Mile Rapids, about 4 miles above The Dalles, Oreg. Upon invitation of a local committee, the Secretary of the Interior authorized the appropriation of an equal amount. The work was carried on under an agreement dated December 12, 1913. The report dated November, 1914, was prepared by L. F. Harza, of Portland, Oreg., in cooperation with E. G. Hopson and O. H. Ensign, of the Bureau of Reclamation. The report was reviewed by a board of engineers consisting of Gen. W. L. Marshall, Ralph Modjeski, D. C. Henny, and W. F. Durand. The total cost of this report and the investigations was $31,984.69.

Work on the Palouse project was resumed December, 1913, and was initiated by an appropriation of $10,000 by the Legislature of the State of Washington. Upon solicitation of the Governor of Washington, the Secretary of the Interior allotted a like sum of $10,000 from the reclamation fund for these investigations. On October 1, 1914, a report was submitted to the Secretary of the Interior and the Governor of Washington after review by a board of engineers consisting of D. C. Henny, C. H. Swigert, and A. J. Wiley, of the Bureau of Reclamation, and Marvin Chase and J. C. Ralston for the State of Washington.

In 1919 investigations were resumed under the direction of the Columbia Basin Survey Commission, authorized by the State of Washington, to which work the Bureau of Reclamation assigned D. C. Henny and James Munn as consulting engineers. A report was issued by the commission in 1920 which was reviewed by a board of engineers consisting of D. C. Henny, James Munn, and C. T. Pease, of the Bureau of Reclamation.

Drilling investigations in the Columbia River near the head of Grand Coulee were carried on in 1921 by the State of Washington, the Bureau of Reclamation acting in a consulting capacity.

The cost of investigations heretofore carried on under the supervision of the bureau was:

From the reclamation fund	$119, 565. 42
From cooperative contributors	24, 975. 88
Total	144, 541. 30

The act of February 21, 1923, authorized an appropriation of $100,000, which was included in the appropriation act of March 4, 1923, for the purpose of investigating the feasibility of irrigation projects on the Columbia River. Under the

act of March 4, 1925, an additional sum of $25,000 was appropriated for completing the work.

The engineering investigations were carried on under the supervision of H. J. Gault of the Bureau of Reclamation. His report, together with the report on land classification, the Board of Engineers' reports of April 6, 1924, and February, 1925, are included in the report of the special commission, August 25, 1925, Columbia Basin project, which commission consisted of Elwood Mead, chairman, and John H. Edwards.

In 1928 a report on soil and economic conditions on the Columbia Basin project was submitted by B. E. Hayden of the Bureau of Reclamation and Prof, George Severance, of the State College of Washington.

The act of February 21, 1923, also authorized an appropriation of $50,000 for the investigation of the Umatilla Rapids project on the Columbia River. By act of February 17, 1923, the State of Oregon appropriated $10,000 for the purpose of cooperating with the United Sgates in the investigation of the project. E. R. Crocker, of the Bureau of Reclamation, made the field investigations and prepared the report which is dated October 17, 1924. An economic report was submitted in September, 1926, by Andrew Weiss and Wm. W. Johnston.

Expenditures on Umatilla Rapids project, $70,541.91.

In September, 1930, a general field reconnaissance was made by H. W. Bashore of the Bureau of Reclamation of the various project units, canal lines and reservoir sites.

A report was prepared September 30, 1931, on the Quincy unit of the Columbia Basin project by R. F. Walter, L. N. McClellan, and E. B. Debler, of the Denver office.

Based upon the comprehensive report prepared under the direction of Maj: John S. Butler, Corps of Engineers of the United Statds Army, the Chief Engineer submitted a report, under date of January 7, 1932, on the proposed Columbia Basin project. The total cost of investigations by the Bureau of Reclamation has been:

Expenditures prior to 1923	$144, 541. 30
Report of special commission 1923–1928	108, 507. 77
Report on Umatilla Rapids	70, 541. 91
Investigation and reports, 1930–31	32, 403. 14
Total	355, 994. 12

Doctor MEAD. And I would like also to file a statement showing the various hearings which have been held before committees of Congress. This is simply a statement of the different hearings, where this project has been under consideration.

The CHAIRMAN. That may be inserted, also.

(The statement referred to is here printed in full as follows:)

HEARINGS ON COLUMBIA BASIN PROJECT

July 10, 1922, hearings on S. 3745 before the Senate Committee on Irrigation, 19 pages.

December 6, 7, and 13, 1922, hearings on S. 3808 before the House Committee on Irrigation, 88 pages.

February 2, 1926, hearings on S. 2663, Senate Committee on Irrigation, 32 pages.

January 11 and 13, 1928, hearings on S. 1492, Senate Committee on Irrigation, 167 pages.

January 16 and 17, 1928, hearings on H. R. 7029, House Committee on Irrigation, 187 pages.

February 10, 1928, hearings on H. R. 8129, House Committee on Irrigation, 14 pages.

Total, 507 pages.

Doctor MEAD. I am not going to discuss the report that we made last year, or any of these hearings.

But I wish to explain the changes which have taken place in the plans for this development and the reasons for the changes.

Mr. CROSS. Doctor, let me ask you this question: Someone suggests that the main feature of this project is the supply of power——

Doctor MEAD. Yes.

Mr. CROSS. It seems to me, and I believe you probably are in accord with that thought, that the main feature is the producing of products to take care of the people, so you can have cities to buy the products?

Doctor MEAD. That is correct, power alone would have little value. Development and creation of a market for power requires that both resources be included in the plan; it is a combination of the two.

Mr. MILLER. As I understand it, the power project is the primary consideration, and the other follows as a natural consequence.

Doctor MEAD. It is not possible, by power alone——

Mr. MILLER. That is the way I understood it.

Doctor MEAD. Yes; that is correct. We have, as I say, this land, and that is the objective. At first power was not recognized as having the significance that it has now.

Mr. MILLER. May I interrupt one more time? This land there will ultimately be developed for irrigation; in whom does the title to that land rest, is it Government land?

Doctor MEAD. No; some of it is Government land, but the greater part of this land was filed on with the idea of growing wheat. You can go up there and find abandoned towns, storehouses, but nobody living there, because they have been abandoned. Now, we have, as part of our investigation, looked up the title to that land. I think we have a very complete record of the titles, and that land is owned in every State in the Union, and in some of the outlying islands. I know some of it is owned in Honolulu.

Those people went there and were starved out, and they had to go some place else to live, but a great many of them wish to come back; it is their dream to return to that country. We have had hundreds of letters from these people, from the owners of that land, asking as to the manner in which these developments would affect it.

As I say, our thought in the first place was the reclamation of this land, and we were starting over on the east side, on the high ground, in order to have a gravity scheme. There were two reasons for that: One was that we could start with a less expenditure of money; and until we came to the Colorado River, we never had nerve enough to think of terms of hundreds of millions of dollars of expenditures. It was the cheapest plan to start, to come down by gravity, but as we went further and further into it, we found this: There was not water enough in the unregulated supply for us to irrigate that entire area, and we would have to have storage, a large amount of storage, and this added to the cost; and then the States of Montana and Idaho have an interest in the water which would have to be stored.

To start from the east side of the irrigable area the first step would be to adjust those rights, just as they have been settled on the Colorado, and those things lead to delays and to interstate complications.

But over on the other side of this irrigable area is the Grand Coulee. From that part of the Columbia River, there is no problem of water shortage or of interstate rights because the river is fed quite largely from mountains, from country that has no irrigation development present or prospective, which has a water supply so abundant and

so unclaimed, that at one sweep, all of these complications about water titles are removed. There is more water than could possibly be used except as it is used for power.

Then, too, we came to realize that, while the greatest value to the country is in the building of agricultural population, the best way to make it possible, without putting heavy burdens on irrigators is to join power development with irrigation development. Since the financial return from power in these works creates solvent investment for the Government and it has a social value in giving better light and power in farm houses and helping to pay the irrigators charges.

Much of the irrigation development of the past 10 years has been made possible by combining it with power development. On the Minidoka project in Idaho it pays the cost of pumping. The Deadwood Reservoir in Idaho is being paid for out of power income. Irrigators who needed the stored water could not pay for the reservoir but by using the power revenue which the falling water from that storage would produce, the reservoir could be paid for.

These are two of the many instances of where power can aid the West in the growth of their cities and towns and industries. It is going to be one of the great financial factors in irrigation development in the future.

We never could have built the Hoover Dam to regulate the Colorado, and change it from being an instrument of destruction into an instrument to continue the growth of the Southwest, if it had not been for the power revenues that could be made a part of it; yet that power revenue was not thought of at the inception of the project.

When it came to the final working out of a program for utilizing the Columbia it was realized that solvency depended on power revenue; that diversion from the main Columbia, rather than from the tributaries of the Columbia, was the best method of procuring both water for power and irrigation. But if we are to do that, we must have a market for this power. Now, I think a market can be found, but it can not be found to-morrow, and it can be found only by the people and the State government of Washington getting behind this project and urging all future purchasers of power to contract for it from the Columbia basin project.

If the State succeeds in securing contracts for this power as southern California contracted for the Hoover Dam power, Congress can then safely provide the money for construction. With development assured, the State has every incentive to create an assured power market.

What is needed then is, to begin right now and say: Here is our program. We are going to make this the great power development of this country, and do this by making it the source of power for all of our industries.

Mr. CROSS. What is the source of Seattle's power now; is it water power, or is it——

Doctor MEAD. Yes, it is water power. There are quite a number of streams coming down out of the Cascade Range that they utilize for power. Recently there was a new power development on the Columbia below the dam, and farther down; the Priest Rapids project, a low dam development; and they are ranked as power developments, but they do not have irrigation as an adjunct. Deadwood as a power development would not justify the Government touching it, but Deadwood as a source of water needed by irrigators but paid for out of power revenues is a wise and profitable Government instrument.

Mr. MILLER. Have you investigated the power proposition? You have various hydroelectric power projects now in existence, especially in the Cascades?

Doctor MEAD. Yes.

Mr. MILLER. Have you investigated the propable effect that this power development might have upon their continuing, and also the effect that any improvement that they might make would have upon your project?

Doctor MEAD. Part of my education, last year, was to find out the attitude of people owning power plants or who are interested in power development, and gathering information on this has gone on ever since, and as a result it is my belief that if this project is carried out along the lines I have outlined, there will be no opposition on the part of the power interests. They realize, as much as any one, that returns from their investments depends on the growth of the country they serve, on the number of people that will buy power. Now, they say, "If by doing this thing, we can build up these cities in our territories, if we can repeople these abandoned farms and make new homes and thereby have a market for more power, this is what we desire.

As a power development alone, they would oppose it; but when power development is coupled with the creation of thousands of new homes, then they want it; it is the greatest bulwark to the investment that they already have, and the greatest opportunity for expansion that can be conceived.

Some of those well informed thought at first that disaster that would come by the injection into this area of a tremendous amount of new power, I said, "If we do not do something of this kind, local power demands will go down, the present incomes will be less than they are now, because there will be less people." That is the real menace to the industrial future of that country. On the other hand, you have but to go to Wenatche and Yakima and see the power bills that come in from the packing and refrigerating plants there, to know what the future market for power this great irrigated area is going to be, and where it is to come from. Now, of course, it is necessary that this be produced or generated cheap enough to enter into competition with the other power plants, but this is possible.

The CHAIRMAN. Doctor, I would like to get this information: Perhaps in my absence this morning the committee covered it, but I remember that the testimony before was that the charge per acre provided this project is put over, will be about $11 to the farmer in the reclamation portion. In your judgment, is that about correct, or have you given any thought to it? I could not tell you who it was, but I think perhaps it was one of the engineers who stated that.

Doctor MEAD. Taking reclamation as a whole, it is high. I will ask Mr. McClellan, our engineer here, Is the proposed charge for power $11 an acre?

Mr. MCCLELLAN. No. Do you mean the annual charge against the land?

The CHAIRMAN. Yes; for reclamation.

Mr. MCCLELLAN. We estimate that operation and maintenance and the depreciation will be $3.19 per acre, and the construction payment will be $2 per acre in addition to that, for the first four years,

and $2.50 for the rest of the period, making a total cost of about $5.25 an acre a year.

The CHAIRMAN. Yes; as I remembered, one of the engineers made the statement that he thought it was $11, and your department would answer it for us accurately. Perhaps you did do that in my absence.

Mr. MCCLELLAN. No, sir; I had not covered that.

The CHAIRMAN. $3 a year—how much did you say?

Mr. MCCLELLAN. $3.19 per acre for operation and maintenance and depreciation.

The CHAIRMAN. Now, Doctor, assuming that to be accurate, and it is as nearly accurate as it could be expected, how would that compare with——

Doctor MEAD. It is low.

The CHAIRMAN. With the acre charge on a successful reclamation project?

Doctor MEAD. Well, it is low.

Mr. CROSS. Pardon me, Doctor, but there was some one went into the crops that would be raised, and some would mention apples, but they did not mention apples being raised on this irrigated area. Would not that be good land to raise apples on? What other fruit do you raise there successfully? I know they raise pears and apples.

Doctor MEAD. Last year, when I was down on the Columbia River near Pasco, they took me out to see some vineyards that are now developed.

Mr. CROSS. Vineyards?

Doctor MEAD. Vineyards, yes; and they are growing the same kind of grapes they grow in California. They are protected in the winter, but they have plenty of heat there in the summer. They grow there, and I never saw a finer yield.

Mr. CROSS. Doctor, that statement convinces me; I am for this bill.

Doctor MEAD. Perhaps I had better stop, then. Well, now, I am trying to bring before you the relation of agriculture and power; they are the two things that make it worth the attention of the United States. The worst thing that could happen to the State of Washington would be an unplanned development, with a little power plant, and a little one over here, and another one in Canada, just to meet their needs as they arose instead of taking one great plan requiring a large initial outlay, and having back of it this agricultural development that is going to enrich all of the State of Washington.

Now, in order to carry out a program of this kind, we have to find a market for that power; and it has to be done by inducing people that would go on with independent developments, to hold off; it has to be done by making this project the concern of Seattle, Tacoma, and Spokane, and possibly Portland; all of those have to be shown, so they will say, "Here is our project," we have got something that is going to do for us about three times what the Colorado River is going to do for Los Angeles," and that is what this bill provides for.

My liking for this bill is not that provision is made for an appropriation but the conditions which govern an appropriation. It is contained in section 4, which reads:

> Before any money is appropriated for the construction of said dam in the Columbia River at Grand Coulee and/or power plant, and before any construction work thereon is done or contracted for, the Secretary of the Interior shall

make provision for revenues by contract, in accordance with the provisions of this act, adequate in his judgment to insure payment of all expenses of operation and maintenance of said works incurred by the United States and for the repayment, within fifty years from the date of the completion of said works, of all amounts advanced to the fund under subdivision (b) of section 2 for such works, except for the amount allocated to flood control, together with such interest thereon as is made reimbursable under this act.

Now the first thing is that the State of Washington has to get behind this development just as the cities and counties in southern California got behind the Hoover Dam. Now, there was a tremendous amount of skepticism in regard to the ability of southern California to do that, and they would not have done it if they had not been required in the first place—before the Government opened its treasure chest for the money—and note what happened. The people in the Southwest did not figure the profit they were going to make out of their power. The Southern California Edison Co. has an investment of over $400,000,000 in its power plants and distributing works in southern California; and now, to make that a good investment, Los Angeles must make good, and there must not be any doubt about the ability of Los Angeles to go about attracting and caring for people there. It was menaced by the question of a water supply.

Profit out of the power was not the main reason they wanted that dam built, they wanted it for the indirect benefit that would come to them; and I do not believe that the Southern California Edison Co. would have signed the kind of contract they did, assuming the obligations that they have, if they had not realized that the safety of the investment that they have, the continuance of income on their present investment, would be safeguarded; and opportunity for greater growth in the future created by Hoover Dam. That is why they came into the picture, and they offered to take the whole of the power and assume the entire obligation. Now, in the Northwest, if all pull together as did the city and power interests of Los Angeles, Seattle and Spokane will have the Grand Coulee Dam as an assurance of a great and continuous growth.

Now, with conditions as they are to-day, it is going to take some time to secure these power contracts. It took about three years to get a unity of purpose and a complete understanding of what was involved in the Boulder Canyon project; but when the Southwest did understand, the water and power department of the city of Los Angeles was ready to take the whole power, because water was the key to their future.

I do not question the success in working out a program in the northwest. I know the kind of people they have. They are not going to be afraid of assuming the obligation to pay to the Government millions of dollars a year, because they know the value of power and irrigation.

The CHAIRMAN. Doctor, the chairman regrets to have to call time, but we have not the privilege of running beyond our time. It is 12 o'clock now, and we would certainly like to hear you through. Could you be with us again to-morrow morning?

Doctor MEAD. I could be, but I am nearly through. I want to say something about section 5.

Mr. HILL. Will you forbear for a few moments?

The CHAIRMAN. Yes; go right ahead, Doctor.

Doctor MEAD. Now, section 5 only adds to the safeguards of section 4 [reading]:

> Before any money is appropriated for the construction of diversion dams, pumping plants, canals, laterals, or other facilities for the irrigation of lands embraced within or tributary to said project, and before any construction work thereon is done or contracted for, the Secretary of the Interior shall make provision for revenues by contract or otherwise adequate in his judgment to insure repayment of all expenses of construction, operation, and maintenance of said works in the manner provided by the reclamation law. Such works may be constructed by divisions or units as specified in section 1 hereof, and contracts for repayment therefor may be made accordingly.

Now two things are provided for. If I went there as an apostle of this, I would say to the people: "The first thing you have got to do is make sure that this power is going to be used"; because Congress has to be convinced and is going to make sure before it approves any appropriation for the power development.

When this bill is passed, you will have safeguarded Congress from any unwise expenditure of money. The Northwest can not come here for any kind of appropriation until these conditions that assure solvency are fulfilled; so that, instead of it being a menace to the Treasury, you simply take one menace away. I think it will take five years to get these contracts, but that ought not be discouraging to the people whose future depends on this legislation. They might do it in less time. So that under the most favorable conditions, with no hitch, irrigation is 20 years off, and by that time I think the agricultural situation in this country will be entirely changed, and long before that time we will realize that this western one-third of the country needs to go ahead, because of the market it furnishes to the East.

Mr. SUMMERS. How many acres per year would be planted?

Doctor MEAD. I would not want to say, especially at the beginning.

The CHAIRMAN. Doctor, I have the idea that some of the members are so interested in your statement that there will be several questions that we would like to ask you to-morrow. If it is convenient for you, I am going to ask you to meet the committee to-morrow morning at 10 o'clock, and continue your statement.

Now, gentlemen, if there is no objection on the part of the committee, we will stand adjourned until 10 o'clock to-morrow morning.

(Thereupon, at 12.05 o'clock p. m., the committee adjourned to meet at 10 o'clock a. m., Thursday, June 2, 1932.)

THE COLUMBIA BASIN PROJECT

THURSDAY, JUNE 2, 1932

HOUSE OF REPRESENTATIVES,
COMMITTEE ON IRRIGATION AND RECLAMATION,
Washington, D. C.

The committee met pursuant to adjournment, at 10 o'clock a. m., in the committee room, No. 333 House Office Building, Hon. Robert S. Hall (chairman) presiding.

Present: Representatives Hall (chairman), Gasque, Fulbright, Chavez, Martin, Smith, Leavitt, Swing, Arentz, Butler, and Loofbourow.

The CHAIRMAN. The committee will come to order.

Judge Hill, have you any statement you desire to make?

Mr. HILL. No; but I ask that Doctor Mead may proceed with his statement.

STATEMENT OF DR. ELWOOD MEAD, COMMISSIONER OF RECLAMATION—Resumed

Doctor MEAD. Mr. Chairman and gentlemen, the fact that we are dealing not alone with the largest river of the arid region, but the river that provides more water than any other two rivers of this region, makes the development a matter of historical importance. What this will do for the whole country can be compared with what happened with the building of the first transcontinental railway, in bringing the country together, opening up new resources, and increasing population and markets. Now, because of this magnitude, I think that before we are through, we may adopt methods that are entirely different from those that are adequate for the building of smaller irrigation enterprises.

Take the utilization of the Colorado River, and I do not believe that Congress would have approved of it, or feel it was a necessary undertaking, if it had not been for the thought that the city of Los Angeles was practically behind it, and underwriting its cost; there were 1,500,000 people, and wealth enough, and interest enough, to make the guaranty of payment safe for the whole country.

Up in northern California they have a similar problem. The Sacramento and the San Joaquin Valleys have been irrigated and settled without any comprehensive plan looking to the protection of the farms now irrigated or securing the largest use of water in the future. Little thought was given to what was to happen a hundred years from now. To capture land and water and get immediate results governed. Now, they have reached conditions where they have more land under irrigation than the water will support, and they must do something like what was done on the Colorado; that is, carry water from streams where there is a surplus to streams that are dry in summer.

For two or three years they have been studying to evolve a plan by which the surplus water of the Sacramento could be stored and made to serve communities that need it. This year they have drafted a constitutional amendment looking to the State issuing bonds or underwriting the development by the United States.

The difficulty is to get the different localities, each with interests of its own, to agree upon a scheme that will justify the United States coming in and carrying out the development.

If you pass this bill, you will put on the State of Washington the task of finding responsible buyers for this power. I feel quite sure that before this is accomplished the State will have taken a very active part, just as the State of California is now taking a very active part, in bringing about the use of water of the northern end of that State and Los Angeles and the Imperial Valley on the Colorado River.

Columbia Basin is a larger undertaking than Boulder Canyon project. Sooner or later the State will become an active agent in working out the kind of contract for power that will satisfy Congress and the people of the State.

I think that is all I desire to say, unless you wish to ask some questions.

Mr. MILLER. Doctor, your statement as a whole is very comprehensive, but I want to ask you one or two questions about certain particulars of the matter. The power that is to be created there, of course, is to come from the storage of water. One of the great problems in hydroelectric development is obtaining a sufficient flow to guarantee a sufficient height of water?

Doctor MEAD. Yes.

Mr. MILLER. Is there any question in your mind—I know you are familiar with the engineering report and with the studies that have been made; but just laying those aside—is there any question in your mind as to the ability of the Government at all times to have sufficient supply of water there to generate or create the energy that you contemplate selling under these contracts?

Doctor MEAD. No; there is not. Take the records of the flow as they exist to-day, and they do not raise any doubt about that; but all the development that is likely to take place in the next 100 years, or at any time, is going to stabilize and make more regular the water that comes down to this power plant if built. I do not believe there is any development proposed that will not improve the water supply for the power wheels that will be below this dam.

There is being built in Canada to-day a large power development. That, in itself, will improve this storage.

Now, last year I took a 2-day trip on Kootenai Lake, which is a part of this supply—in other words, it is a tributary lake. It is a reservoir which we could not contemplate as an artificial storage.

Over in the Clarks Fork country in Montana and Idaho, whatever development they have there is almost certain to be in connection with storage. That will reduce somewhat the flood flow, but will increase the low water supply. There is the Coeur d'Alene Lake, and a great number of lakes that are to be regulated, the effect of which is to equalize the flow of the Columbia. In Canada there is a heavy snowfall in the mountains, with no chances for irrigation, so

that I feel there is not a superior water supply in any part of this country.

Mr. MILLER. You know, as a matter of fact, and especially that is true in development in the South of those water projects, that we are confronted with droughts, and the question of storage is the most serious question we have to deal with in producing electricity on southern streams.

Doctor MEAD. Yes.

Mr. MILLER. And I just want your expression on that question.

Doctor MEAD. These conditions are different. The water comes from high mountains, the lakes are natural reservoirs; it is a region of heavy snowfall.

Mr. CROSS. In what seasons of the year do you have your low water?

Doctor MEAD. In the late fall, winter, and early spring.

Mr. SUMMERS. Doctor Mead, the Army Engineers made reference to repayment within 30 years, and at 4 per cent interest. You or Mr. McClellan made reference to repayment within 50 years. What is the explanation of this apparent discrepancy?

Doctor MEAD. We took 50 years because we felt that, if 4 per cent interest is paid to the Government, it would not make any difference if it was 100 years before it was repaid, and we used the same repayment period as in the Colorado River contract.

Mr. SUMMERS. I see. We could make our contracts for 50 years, and then the Government would be repaid for that borrowed money, or anything of the kind, at 4 per cent?

Doctor MEAD. Yes; and we want to use part of that money to help pay for the construction of the irrigation works.

Mr. MARTIN. I could not be here yesterday, but did Doctor Mead touch on the irrigation of the new land that would be brought in by this project; did he touch on that yesterday?

The CHAIRMAN. Yes, he did.

Doctor MEAD. I would be very glad to go into that again.

The CHAIRMAN. You may propound any question, General Martin, that you desire.

Doctor MEAD. I would be very glad to speak of that again. What I said was that the period of irrigation development is in the future. In the first place, it will probably be five years before the power contract required under this act is signed, about the best we could expect. Then it will require ten years to build the dam and power plant.

Mr. MARTIN. Ten years on top of the five?

Doctor MEAD. It will be 15 years before we will have any water for irrigation or the power with which to lift it on the land. Then the power contract demands will have to be met and money provided by Congress or out of power revenues to build the irrigation canals. If there is any objection to irrigation 15 years hence Congress can delay irrigation development then.

I think it will be another five years before a scheme for financing the irrigation works and it will no doubt provide for construction in sections; that is, we will build canals for the Quincy Flat, which is one of the finest bodies of land in the world. That means it will be 20 years from the passage of this act before irrigation of these lands assumes any importance.

Now, by that time, if Los Angeles grows and Seattle grows and Tacoma grows, the East can forget everything that is grown there; all the surplus crops will be consumed in Pacific coast cities.

A few years ago the dairy products of Idaho went east, the surplus now goes to Los Angeles, and as these coast cities grow, more crops move west. We talk about things grown in the arid States competing with the East, but if you will study the freight movements you will find that while Washington can grow corn on its irrigated areas, its farmers are not growing corn for export; on the contrary, they are shipping corn from Nebraska to feed stock on irrigated farms, because it does not pay to grow corn. In the orchard areas feed for work stock is shipped from the East.

This large coast consumption of irrigated products has grown greatly in the last five years. California, for instance, with its population increasing enough to give them nine more Congressmen, has that many more mouths to feed.

Mr. CROSS. Doctor, will you have enough grapes to allow us some?

Doctor MEAD. I tell you, the grape business is in its infancy.

The CHAIRMAN. Doctor, it has been suggested in the hearings that the completion of this project would be very beneficial to our national defense; first, the intrinsic value of the power of this project, and, secondly, for developing the western country, for the growth and development of the Pacific coast. Would you care to express an opinion on that?

Doctor MEAD. Well, we only have to think what the western one-third of the country, the arid region, was, a few years ago, when the only inhabitants it had were jackrabbits and coyotes. We have to think of how little it did for the rest of the country, when it was only a stock range, and then we have to think of the thousands of automobiles that go from the East out there; when we changed that, and began to dot homes all over that country, or the farmers that made enough money to buy automobiles and radios and a Sunday suit of clothes, all of which comes from the East; you have to realize that once the traffic of railroads was from beyond the desert rather than from the interior.

Mr. CROSS. Doctor, is not that a great big country? Can not that country produce lots of beets; is not that a fine beet-growing country?

Doctor MEAD. Yes; I think the north one-third of this irrigation area is the best beet-growing country in the United States, and it gives the largest yield and gives the highest sugar content.

Mr. CROSS. It would make it independent of the other countries.

Doctor MEAD. Yes.

The CHAIRMAN. I think Doctor, you stated yesterday that agriculture, in your opinion, the business of agriculture was passing through a swift, speedy change, and that, in a very few years, the agricultural resources of the country would be on an entirely different basis, as we know it. I am curious to know just what you meant by that.

Doctor MEAD. Well, five years ago we were having difficulty in getting settlers for our irrigation projects. In 1924 there were thousands of acres of unoccupied land, that we had not settlers for; now the movement is back to the land.

When we came to get money for the Vail and Kittitas districts, that matter was referred to the committee, and they said, "You have

so many acres of land in these different projects that nobody wants we do not see any sense in appropriating money to build more canals, when you have not occupied the country that is already supplied with water." Well, we tried to explain the magnitude of this area and what may be the requirements of one locality, will not be true of another locality.

It does not do any good to say to people that there is plenty of corn in Nebraska if there is a group of range stockmen out in Montana whose cattle are starving. They can not afford to ship corn from Nebraska; what they need is a chance to grow the feed that they need. The use of the public range depends on that. We explained that irrigation was needed in the Kittitas district, because it could not go any further without it. A large number of people had settled there on the little side streams, thinking there was water enough. They saw nice looking streams there in the spring, and they spent money developing the land and building nice houses, and they would start crops in the spring, and those crops would burn up along in August.

Now, I have a peculiar sympathy for those people, because a group of those farmers came down to Berkeley, Calif., where I was professor of rural institutions, and they said, "Now, you have studied this. We have taken our money and our time and have taken our families up there, and here is what has happened: We have put in crops, and they would burn up. Now, what are we going to do? We want you tell us."

I told them: "You have got to go to the main stream. You can not depend on those small streams. There is only one place you can find water enough, and that is the main stream."

They said, "We can not do that; we are broke. What has happened to us in the last four or five years has taken all of our capital."

So, when I came here, I was in favor of the Cle Elum Reservoir to carry the water of the main stream down to that country, and it is being built. Now, whether there was a single settler under a canal in another State has no relation whatever to the plight of those people.

So, we said, "The settlers are there now." The committee insisted, and I am glad it did, that the people from the project should come here and guarantee that they would take this water.

Now, the representative of that country who came here was born in Winchester, Va., and he knows both sides of the country; he knows what is good for the welfare of both and he told us, "If you build this canal, we will guarantee that the water will be taken the first year; we will get up a credit system to help finance the people that are coming in and can not pay, and the State itself will get behind this development."

That was good enough and they voted us the money.

The other canal was in the State of Oregon, and the representatives of the State and of the locality came here, and they said that the State of Oregon had an organization for finding settlers, and they said, "We will find settlers, and if the settlers need help we will find some way to finance them." Anyhow, we started the canal and I went out there in the fall of the first year after the water was turned in, and I do not ever expect to have any more satisfaction than I had in the visit to those two projects.

They had an exhibition of the products grown the first year, right off the sage brush, and the only land upon that project that was not

in full cultivation, was two homesteads, and they could not settle the title. All the land that they could go on and cultivate was in cultivation. Now, on the Kittitas project——

Mr. MARTIN. This, that you are speaking of, is the Vail?

Mr. MEAD. Yes, the Vail project, up in Oregon.

Mr. MARTIN. The Portland committee helped you to get settlers there; did it not?

Mr. MEAD. Yes. Now, I do not want to run away with myself on this——

The CHAIRMAN. Any other questions, gentlemen?

Mr. MILLER. Doctor Mead, is it not a matter—is it not true that, as a matter of general knowledge, that whenever land that is in the arid region or in the flood region, whenever the land is fertile, is thrown open for settlement, with the guarantee that a supply of water will be there, or that the flood waters will be held back—as a matter of fact, are not those lands settled and settled by people who become self-supporting and contribute to the national wealth?

Mr. MEAD. That is true now. Four or five years ago, it was not true. I do not think these lands would have been settled, if we had not had the States of Washington and Oregon behind this, to let the people know they were there.

Mr. MILLER. That is what I mean.

Mr. MEAD. Five years ago when we found it difficult to get settlers, some one said to me: "How can you expect to get settlers when wages are so high in factories, and prices what they are on the farm?" One man said: "The State of Michigan is moving into Detroit and into the Ford factory at the rate of 10 miles a year."

Now, they are moving back. The letters we are getting in recognition of the fact that, if a man was on a farm, if he could not make $6 a day, he could have plenty to eat and if depression continues we are going to put a man on every farm that you will provide water for, everywhere in the arid region.

The CHAIRMAN. Doctor, I am looking at this project as a large national policy.

Mr. MEAD. It is not a local one.

The CHAIRMAN. Let us see the situation as we find it to-day. We know that industry has reached the saturation point for a number of years, and we also know that we have 8,000,000 or 10,000,000 people without employment; charity, we recognize, is gradually failing. Now it occurred to me that this Government must look upon that proposition, look upon the facts as they are, and it rather occurs to me that this is a wise time to think about getting people back to the acres in this country of ours.

Now, would this project aid in that idea?

Mr. MEAD. Any project of this kind, and this project will aid in that situation when it comes on, because it will furnish an opportunity for the very best kind of homes. What is going on to-day is illustrated by the fact that one man in the Government employ who came to me recently, and said: "I have a cousin who was on a farm in Utah and he got the offer of a place in New York City that paid better than his farm, and he went there. He had only been there a year when this depression came on, and now for a year he has been out of work, he has been tramping the streets and trying to get another job, and he can not do it, and I have to support him." He said: "He

knows how to farm, and it just occurs to me that if he could get back on a farm I can afford to stake him for what he needs." And he wanted to know where he can go. Well, we had fine land and we had water where he could start on at $1 an acre, and where he would be a great deal happier than walking the streets. He is on a farm.

That is one instance, and that settled one family—that man, his wife, and his children. The more we can do of that sort of thing, the more we are going to lessen this great question of how we are going to take care of the people that are out of work.

Mr. MARTIN. Doctor, do you not think you can take some of this bonus army here back on the land?

Mr. MEAD. Well, they would be happier than they are here.

Mr. MARTIN. I am seeking information now. Did the Doctor yesterday dwell on what it would cost to irrigate this land?

The CHAIRMAN. Yes.

Mr. MEAD. It is not a question of the total cost, it is a question of how much it costs per year.

Mr. MARTIN. That will be in the hearing?

Mr. MEAD. Yes.

Mr. HILL. Have you finished, Doctor?

Mr. MEAD. Yes.

Mr. HILL. We want to thank you very much, indeed, for your very wonderful statement.

The CHAIRMAN. We certainly do, Doctor, for your illuminating statement, which will be of assistance to us. We thank you very much for coming up.

Mr. HILL. Mr. O'Sullivan, are you ready to resume your statement that you started yesterday?

Mr. O'SULLIVAN. Yes, sir. If it is agreeable to the committee, in order to save time, I will submit the statement for the record, as I did yesterday, after commenting on the main points.

Mr. HILL. I am sure that this arrangement will be satisfactory. You may proceed.

STATEMENT OF JAMES O'SULLIVAN—Resumed

Mr. O'SULLIVAN. In the oral statement given yesterday, it was shown that the Columbia Basin project could not possibly interfere with present alleged crop surpluses; that the project would be devoted mainly to the production of hogs, cattle, dairy products, sheep, lambs, wool, etc.; that there is a shortage of this class of production either in the far West or the United States as a whole; that the Army report shows that by 1960, the increased population of Idaho, Oregon, and Washington will require the entire agricultural production of the basin project; that in the past decade the Western States have grown much faster in population than the United States as a whole; that the far western States are not to-day producing sufficient staple feed and food crops to feed their own population and are shipping in large quantities of pork and canned beef and considerable dairy products; that these States are now obliged to ship much of this deficit food supply from the Middle West which is producing tremendous surpluses in these lines; and it was also shown that the basin lands, when irrigated, would be several times as productive, per acre, as the farms of the United States.

Let me call your attention to a few points in the statement to be filed to-day. The 11 far western States constitute an economic unit

practically isolated, through long freight hauls, from the rest of the country. In common, they can not possibly make any further progress without reclamation. If you stop the expansion of their agriculture, you stop their remarkable growth; you stop the development not only of agriculture but also of all their resources that must have agriculture as a basis.

Now this statement shows that in 1930, according to the Secretary of Agriculture, Arthur M. Hyde, the United States imported enough agricultural products that it can successfully raise itself to justify the cultivation of 10,000,000 acres of land. You will find Mr. Hyde's statement in the Yearbook of Agriculture for 1931. We are shipping into the United States enormous quantities of cattle; canned, chilled, and frozen beef and veal; and one-third of our wool supply, and so forth.

Mr. CROSS. Sugar?

Mr. O'SULLIVAN. Yes; enormous quantities of sugar. The basin project will not and can not compete with the rest of the country. It will supply only the deficit crops and deficit meat requirements. It will supply wool and for 10 years we have been importing one-third of our wool. It is really unfortunate that physical and financial considerations make it impossible to reclaim any of the basin project for perhaps 20 years. I am sure that that project, with its wonderful productive capacity, will be needed sooner.

The statement shows that according to the Army report the construction of the project will create values in that region, values that can be assessed to help pay for reclamation, that will exceed the cost of the reclamation by $33,000,000. The report shows that the annual expenditures made by the farmers on the project will be about $51,000,000, more than half of which would be spent for articles manufactured in the East. The statement shows that the construction of the project, by increasing population and wealth, would increase Federal income tax payments annually $10,000,000 and it has already been shown that after the project is paid for the income from power that will go to the Federal Government will amount to better than $15,000,000 annually. The statement shows also the great decrease in the population of the basin area in the past two decades, due to drought and the marked increase in population, in the same period, in Chelan and Yakima Counties where they have extensive reclamation.

That is all I have to say.

Mr. HILL. You will file your statement with the committee?

Mr. O'SULLIVAN. Yes.

The CHAIRMAN. The statement may be incorporated in the record.

(The matter above referred to is here printed in full as follows:)

Nearest market to obtain staple farm products.—The nearest market in which the far western States can purchase their deficit feed crops and food supply is the Middle West, located between 1,500 and 2,000 miles distant, especially from the concentration of far western population that exists along the Pacific coast.

United States importing huge quantities of food.—In the year ending June 30, 1930, according to the statement of Arthur M. Hyde, Secretary of Agriculture as made in the Yearbook of Agriculture for 1931, the United States imported from foreign countries enough farm products that it could successfully raise itself to warrant the cultivation of up to 10,000,000 acres in the production of these deficit farm products. These importations have since been decreased somewhat by the tariff of 1930 and the depression, but they are still huge. In the year ending June 30, 1930, and in a few cases in the year ending June 30, 1929, where the figures for 1930 are not given, the United States imported,

among other farm products, 419,000 head of cattle, 128,089,183 pounds of canned, chilled, and frozen beef and veal, 25,500,000 pounds of casein (made from skimmed milk), 21,552,000 pounds of sausage casings, 218,438,000 pounds of wool, 2,851,000 pounds of butter, 78,261,000 pounds of cheese, 337,000 dozens of eggs, 22,957,000 pounds of dried, frozen and preserved eggs, 197,657,000 pounds of raw cotton, 7,013,000 long tons of unmanufactured flax, 10,055,000 pounds of dried currants, 1,229,000 boxes of lemons, 27,951,000 pounds of rice, 1,085,000 pounds of rice flour, 12,948,000 bushels of wheat, 24,302,000 pounds of walnuts, shelled and unshelled, 13,333,000 pounds of soybean oil, 19,652,000 bushels of flax seed, 2,357,000 pounds of red clover seed, 3,641,000 short tons of raw cane sugar and 4,007,000 pounds of unmanufactured tobacco.

Basin project will not compete.—The major alleged surpluses are in wheat and cotton. Cotton can not be grown on the basin project. It will not pay to grow much wheat on the project although in the past decade wheat production in the United States has increased but 2 per cent while our growth in population has been 16.1 per cent. The project is designed to produce mainly beef cattle, hogs, sheep, lambs, wool, and dairy products, all of which constitute deficits in farm production in either the far West or the United States.

No consumers' agricultural surplus.—In the yearbook of agriculture for 1931, the Secretary of Agriculture states that there was then no appreciable agricultural surplus but rather a great price decline resulting from the lack of buying power caused by the depression. The return of prosperity and buying power will dissipate the idea that there are surpluses in our farm production beyond the consumers' capacity to use and to buy. The remedy for making agricultural prices correspond with those obtained by industry lies in other measures than the suppression of reclamation.

Opponents of reclamation advocating increased farm production and acreage.—The activities of the Department of Agriculture are directed mainly toward increasing farm production per acre and per unit of livestock. It also plans to utilize marginal and submarginal land in the humid region by the extensive use of fertilizer. The minutes of recent meetings of the national land use planning committee and the national advisory and legislative committee on land use, committees sponsored by the Department of Agriculture, show clearly that the department and the committee plan to put back into production millions of acres of marginal land in the humid acreas that are now off of the tax rolls. The increased production that will result from this activity will overshadow any possible production on the Columbia Basin project.

Local benefits from basin project.—The development of natural mineral resources and resulting industry in the Northwest that will result from the placing on the market of a vast block of cheap hydroelectric power will be incalculable. In addition, the Army report shows that the construction of the project will increase assessable values in that area to the extent of $33,000,000 in excess of the cost of reclamation, as follows:

Railway franchises, increase	$33,046,875
Power company franchises, increase	81,837,000
Farm land increase	37,600,000
Local increases in land value	25,000,000
Regional increases in land value	40,000,000
Total	217,483,875

National benefits.—The project, itself, not to speak of other sections of the Northwest, will furnish an increased annual market for eastern manufactured goods amounting to at least $25,000,000. The Army report estimates that the following annual disbursements will be made by the settlers on the project:

Hardware and machinery	$1,465,344
Lumber and building material	2,412,641
Autos, trucks, and tractors	10,932,932
Furniture and supplies	2,482,465
Dry goods, drugs, jewelry, coal, ice, etc	11,791,320
Food and eating places	5,960,998
Personal services, amusements, etc	3,716,020
Interest on borrowed money	3,571,080
Livestock, working stock, and feeders	490,600
Taxes (county)	3,000,000
Annual payments on project	6,000,000
Total	51,823,400

Increased Federal income taxes.—In 1929, the citizens of Washington, Idaho, and Oregon paid the Federal Government $20,971,532.07 in income taxes. It is safe to assume that the increase in these taxes will be in proportion to the estimated increase in population in these States by 1960 and that, therefore, the increase in Federal income taxes paid by their citizens will be $10,000,000 annually.

Income from power.—The United States Reclamation Service estimates that the value of Grand Coulee power at the switchboard will be 2.25 mills per kilowatt-hour and that there will be 7,000,000,000 kilowatt-hours for sale. The net revenue from this power, after the project is paid for, will be close to $15,000,000 annually. Whether all of this fund goes into the reclamation revolving fund or part of it is allocated for further Columbia River development, it will constitute an immense annual revenue for the Federal Government.

Soil erosion.—There is much soil erosion taking place on the basin lands as the result of long-continued drought, the burning out of the humus in the soil, and wind action. In the spring and early summer of 1931, the situation became acute. Dense clouds of rich top soil from the basin and surrounding lands were carried far out on the Pacific. It became necessary to turn on the lights in Portland during the day. If this erosion continues for a considerable period, the richest body of soil in America awaiting reclamation will have become permanently destroyed. This is a national problem.

Decrease in population.—Since 1917, eastern Washington has been afflicted by excessive drought. Population and farm production has decreased at an alarming rate thus undermining large investments in cities, towns, railways, and general business that were made on the basis of conditions that existed prior to 1917. From the Fifteenth Census, 1930, we get the following figures on population:

County	1920–1930	1910–1920	County	1910–1930	1910–1920
	Per cent	*Per cent*		*Per cent*	*Per cent*
Adams (in Columbia Basin)	−19.8	−11.9	Grant (in Columbia Basin)	−27.1	−10.7
Chelan (irrigation)	51.3	38.4	Kittitas (irrigation)	2.4	−4.4
Benton (irrigation)	.4	37.4	Lincoln (wheat farming)	−21.6	−13.7
Columbia (wheat farming)	−12.6	−13.5	Okanogan (irrigation)	8.3	32.6
Douglas (wheat farming)	−19.5	1.8	Whitman (wheat farming)	−10.6	−5.9
Franklin (in Columbia Basin)	4.4	14.1	Yakima (irrigation)	21.5	52.7
Garfield (wheat farming)	−5.5	−7.7	Walla Walla (wheat farming)	3.3	−13.8

Depopulation in Franklin County in the wheat section has been more than offset by irrigation near Pasco and railway activities. The counties having substantial irrigation have more than held their own while Yakima and Chelan Counties, where irrigation is concentrated, have made very substantial growth. Otherwise, the decline in population has been marked.

Douglas County typical.—What has happened to Douglas County since 1917 is typical of conditions prevailing on the Columbia Basin and surrounding wheat lands. The chamber of commerce of Waterville, county seat of Douglas County, and the treasurer of this county, furnish the following data relating to the condition of that county: Since 1920 the population of the dry-land area of the county has declined 49 per cent, the assessed valuation of the dry lands has decreased 56 per cent, the assessed valuation of the towns of the dry area has decreased 65 per cent; precipitation has declined from an average of 13.34 inches per year prior to 1917 to an average of 8.83 inches annually; wheat and other grain production has decreased from 5,000,000 and 4,500,000 bushels in 1915 and 1916 to less than 500,000 bushels in 1930; and the number of banks has dropped from six, with deposits of over $4,000,000, to one, with deposits of between $200,000 and $300,000.

Out of 1,143,680 acres of land, Douglas County, in 1930, had 7,280 acres in irrigated farms. Since 1920 the valuation of the irrigated land has increased 75 per cent and the population thereon has increased 118 per cent, now constituting 48 per cent of the total population of that county. In 1930 the assessed valuation of the dry farm lands was $3,724,002 and that of the irrigated lands, $1,786,170. Irrigation has proved the salvation of Douglas County.

Prosperity of United States depends upon home market.—Better than 90 per cent of our total trade is at home. The policy of economic isolation whereby foreign countries have erected prohibitive tariffs against our exports has greatly reduced and will continue to reduce our exports. Since 1914 payments for our exports have been largely financed by loans that we have made abroad or by the purchase of our securities held abroad. These loans have largely ceased. To sell our

manufactured surplus abroad, we must now open our rich home market and permit the importation of large quantities of goods, particularly agricultural. Rather than suffer this calamity, the United States must soon take measures to increase the volume and purchasing power of our domestic markets. It must lay the basis for a large increase in our population by creating economic opportunity. It can do this by developing our vast natural resources, particularly our water resources. Such empire-building projects as the Mississippi improvements, the St. Lawrence waterway, the Great Central Valley project in California, the Columbia Basin and others must be undertaken or completed. The sooner our home market becomes able to absorb nearly all of our production, the sooner we will be free from economic dependence upon the rest of the world.

No interstate compact allocating the water needed.—The Columbia Basin project is entirely within the State of Washington. It requires no storage of water outside of the State either for power or for irrigation. Any benefits that may accrue to interests on the main stream of the Columbia River from storage in Idaho and Montana can be assessed to those interests in proportion to benefits under the terms of the federal water power act without any compact between the States: The use of the waters of the Columbia River for the Columbia Basin project by diversion through the Grand Coulee can not injuriously affect the use of the waters of this stream and its tributaries for irrigation requirements in Idaho, British Columbia, Montana, and Oregon. The report of the district engineer, Seattle, in paragraphs 252–264, inclusive, shows that there is an abundant water water supply in the upper Columbia and tributaries to provide for all possible irrigation requirements above the Snake River, including those in British Columbia, Idaho, and Montana, with but slight detriment to power development. There is also ample water to provide for all possible future irrigation in Oregon that is practicable from the Columbia River.

The Columbia Basin project benefits Oregon in every possible way. The immense storage created by the dam in the Columbia at the head of the Grand Coulee will greatly increase the prime or commercial power at every dam site downstream and will reduce the floods in the lower river. The water diverted for irrigation at the Grand Coulee site is diverted mainly during the flood season and according to the army report 28 per cent of this water finds its way back in the lower Columbia during the low-water season, thereby adding to the prime or commercial power on the lower river.

Mr. HILL. Now, Mr. Chairman, Representative Johnson and Representative Horr are here, and I would like to take them up in that order. Mr. Johnson, will you make a statement?

STATEMENT OF HON. ALBERT JOHNSON, A REPRESENTATIVE FROM THE STATE OF WASHINGTON

Mr. JOHNSON. Mr. Chairman, Mr. Hill, and gentlemen of the committee, I shall take very little time.

My views dovetail exactly with the statement just made by Director Mead, and the inquiries made by the chairman himself. A steady increase in the population of the United States is certain for each 10-year period, even with immigration greatly reduced. The increase will be the children of our own citizens, and the question which confronts all of us is, What we do with these children?

I want to indorse the statements which have been made as to the certainty that the movement back to the land has begun. It has become necessary after 15 years' extravagance, after 15 years at high speed, after 15 years of moving to the cities. Now we are on the bottom. We can contemplate all these things.

The gilded age is over. I am not so sure, Mr. Chairman, that the United States of America has passed its golden age, and that during the time of this and the next generation we will be in a process of settling down. In fact, for a very long period we wil. live at a slower, a saner, and a safer speed. Yes, that means, generally speaking, a

lower standard of living—but, nevertheless, a much higher standard than that of any European country.

Economic pressure is now making the people look from cities to the country for places to live. The economic pull has been the other way for a long time. If the return movement can not be encouraged and helped—I mean helped literally—the dangers to civilization from excess population in the crowded cities will be very great. We can see the signs now.

Everybody knows that the population of New York City, 6,000,000 right in and around Manhattan Island, and in the immediate commercial area of New York fifteen or twenty million more, is too many for safety, too many for their own future, and for the future of their children. Do we stop to think that, every year, in this United States of ours, with 123,000,000 people, about 1,000,000 boys and girls come of age, with 85 per cent to 90 per cent of them wanting and needing work.

This last 25 years, the great automobile industry absorbed nearly all of that supply. It put hands to work in the mines, in the forests, in factories, of every kind, in the petroleum fields, in the gas stations, on the railroads, and everywhere. I do not see any other gigantic industry ready to take up the enormous slack now.

So, gentlemen, it must be back to the farm in order to live and have a roof over one's head. It may be a slow process, but it is certain to come. Back to the farm, and I hope back to days of more contented life within the home, without the continuous desire to have the high lights and the bright lights. Certainly we must do what other countries, as they became congested in population, have done. They have developed contented people; and in such development lies the safety and future of this great country of ours.

Mr. MARTIN. How are you going to get these people out of New York and these great centers?

Mr. JOHNSON. It will start through the pioneer spirit that is always in youth, in my opinion. The pioneer spirit urges, and the necessity for existence demands. In earlier days our citizens by millions underwent the great hardships of pioneering. They had the desire to own land. It is a human instinct to desire some place of one's own, and to bring up a family around you.

Mr. MARTIN. That is true; that is the most distressing condition in our land to-day, the loss of land.

Mr. JOHNSON. Yes, General Martin, it is said that during this period of violent change, titles will have to be lost by countless thousands who have borrowed. That is the history of all panics. But, perhaps, those now losing titles can be helped to save portions of their holdings. The newcomers, crowded out of the cities, will have to struggle to secure some of the other fractions. Lands will revert to the States, and should be offered to the population in much smaller tracts. I think the States will have to help, and the Federal Government, also, more directly than we can now foresee. If so, that will be of more benefit than a dole, or construction of a great number of public buildings, even better than more extension of expensive, highly built, federally aided roads.

And this leads me to a direct indorsement of the great Columbia Basin project—Federal and State aid and private capital—in this case, meaning the purchase of power. The people will be ready to

occupy Columbia Basin long before we can have it ready for the people.

I want to congratulate this committee on the fact that it decided to take the time right now, when everything is at such a low ebb, to approach a project of this magnitude and this historical value, when it is bound to get the most careful study, at a time when immediate conditions might seem to be adverse to it.

Mr. Chairman, you can prove much that I have said. Ask any street-car conductor you meet in the city of Washington where he would like to go, and he will say, "To the land." Ask him as to the future of his children. He will answer that he is sitting up nights worrying about that all-important problem. What will he do with and for them? Ask him what he thinks about his children when he was sitting up at night, thinking about it. Our fathers and mothers gave us what education they could and knew that the United States was filled with opportunities for all of us.

The fathers and mothers of children now can not see much future for them. And yet there are boundless opportunities in the United States. The problem is to make the contact. Homestead laws did that for us for a long period. Reclamation helped next. Then came the pull to the cities—the wage pull. That has collapsed, and we have no bridge to help the people back to the soil.

The CHAIRMAN. Do you not think you are safe, Mr. Johnson, in taking the premise that they will go back to the farm voluntarily?

Mr. JOHNSON. I know that they will in time.

The CHAIRMAN. To go a little further, do you not think that necessity of conditions will force them back?

Mr. JOHNSON. Yes; that will be the moving spirit. And I think the States will help, the railroads will help by taking many lessons from the late James J. Hill, the "Empire Builder." I think another thing will happen: We are speaking of many transitions. The long haul of the railroads, of transportation, is expensive as outlying communities grow, and I look to see a readjustment of rates, a lowering within a medium range, say in 750 and 1,000 mile area, which will be less costly and enable people to live better.

This Nation is now 123,000,000 people. When our forefathers went to war against the mother country, the population of the colonies was only 3,000,000 people. That was more than 150 years ago. The State of Washington alone now has one-half as many people as those colonies had then. It has been truthfully said, and it is a pure matter of economics, that as a locality increases its demands increase, and helping one locality helps the general uplift, and does not drag down and pull away from other communities that are growing.

I have wondered many times what we would do in the United States if we had but one-half of such area as we have. We would step right in and develop it all to make it useful to the population which would be crowding us. But we are a large nation, and we hear so much talk that we have got so much area, that we can take care of additional millions and millions of people. We can not do that, if we do not make ready.

The CHAIRMAN. Mr. Johnson, do you not think that is the duty of good government?

Mr. JOHNSON. Absolutely, and I want to say, in that connection, that we may feel now that we have been extravagant in expenditures

by both private and public capital. But almost everything that has been constructed in the last 15 or 20 years with public money is still an asset to the country.

The fact that times are hard does not ruin or destroy anything that we have built, which stands yet as a value for the good of the whole people of this country. For instance, the reclamation of the whole Mississippi Valley from the flood offers tremendous benefits, and makes safe the return of the people to their lands in all that area that is being made safe.

In conclusion, let me say, if you run over the legislative history of the whole United States, the things that stand out big and strong are those things that led to great developments of areas. You may take all of the new area, Florida, the Louisiana purchase, Texas, California, Alaska; all of those things were the work of the members of earlier Congresses who had great vision. In looking back, we find that people were saying they were making great mistakes, but at the present time, we know they were not making mistakes at all. So I congratulate the committee on your labors, and on what you will do. I thank you for your attention.

Mr. HILL. Mr. Chairman, I desire to present Representative Horr, of Washington.

STATEMENT OF HON. RALPH HORR, A REPRESENTATIVE FROM THE STATE OF WASHINGTON

Mr. HORR. Mr. Chairman and gentlemen of the committee, we have listened several days to the reports submitted by different bureau heads and department engineers, and it is very heartening to those of us who come from the State of Washington to hear these officials give their statements, setting forth so intelligently the scientific reasons why the Columbia Basin project will be successful, and the great economic benefits which will result from this project.

I want to bring you a message from the Pudget Sound country, from the city of Seattle—the area which will eventually, without doubt, use a good portion of the power developed at the Coulee Dam. This great project has made the people of my district realize the necessity for their future development in unison with the section of the State east of the mountains. We have been imbued with a full appreciation of the interdependence of the eastern and western sections of the State through exchange of products and resources. Development of eastern Washington will develop the Puget Sound area also, just as it will benefit the entire Nation. Therefore, I first want to express on behalf of Seattle a deep interest in this project.

We are proud of Seattle. Our city is the largest city in the world of its age—75 years old. Seventy-five years ago there was nothing but a sawmill there, and to-day we have a city of 367,000 people, absolutely within the city limits. It is not like other cities, scattered over a great area. But just outside of the city limits and within the metropolitan area, we have one-half million people.

The poeple of Seattle depend on urban activities for a livelihood, and a city is naturally dependent on the hinterland back of it. Our people now are deeply conscious of the fact that this project will open up a vast new hinterland, which will in a generation or two, furnish homes for 1,000,000 additional people. This population

would be a tremendous asset to Seattle and the Nation. But I will dwell on this feature in greater detail in a few minutes, when I have discussed the project itself.

It is absolutely impossible to comprehend the immensity of this project until you have been over the Grand Coulee country. I have had the opportunity, in the past year, of going over this project four times with different Members of Congress representing different committees. I want to say to you, gentlemen, if you could have viewed it and appraised at first hand the possibilities of its development, you would not hesitate to give to the Nation your approval and assistance in the harnessing of this great natural resource.

The country to be developed is really a reclaimed territory. One can go through this district and see ghost towns that at one time housed happy people; and abandoned farms, at one time the homes of contented and prosperous people. It may seem strange that these farms can not still produce. But when we note the difference in rainfall when this region was first settled, between the rainfall to-day, you can see that failure was largely due to this lack of rainfall.

We have a condition there, gentlemen, which even caused the chairman of one committee who visited this district, to give way to tears, after having passed through this desolated territory and having viewed the people thereon.

Within my own memory I can look back upon the adjoining Yakima and Wenatchee country, when there was nothing there but jack rabbits and rattlesnakes and a few scattered settlers. But since the advent of irrigation in these districts they are among the most thriving in the State, and the products shipped to and from them have been a boon to the Puget Sound cities, helping to keep our ports busy and lessening the great suffering arising from the depressoin. With this project in the neighboring Grand Coulee country under way, the whole State whould be tremendously benefited.

This project embraces the development of 1,200,000 acres of arid land, and a power development of 2,000,000 horsepower. Out of this power yield, 1,300,000 horsepower will be available for sale, resulting in tremendous revenue which will go to the Government. Besides this there will be considerable secondary horsepower for sale. This project is much larger than Boulder Dam.

Increased valuations due to this reclamation would amount to $217,000,000 or $33,000,000 more than the cost of reclaiming the land.

The Army engineer's reports and the report of the Bureau of Reclamation show that the sale of power would pay for the entire construction of the power plant, and for one-half of the reclamation, within 50 years. This would leave a net income to the Government at the end of 50 years of from $10,000,000 to $15,000,000 a year—a much better project from revenue standpoint than Boulder Dam.

An appropriation of $260,000,000, allocated over 20 years would be sufficient to carry the project through. This appropriation need not be made in a lump sum, but would be distributed in fractional amounts over a 20-year period. After that revenue derived from sale of power would care for the remainder of cost.

The reports show that by 1960 the estimated increase in population of the Pacific Northwest States, which include Oregon, Washington,

and Idaho, will consume the entire production of this project. This does not take into consideration the California market, which by that time will consist of an estimated 10,000,000 population.

Development of this area will create a market for products of other States. Such products include building materials, clothing, machinery necessary in agricultural and constructural activities, and so forth. With the building of cities and towns in this area, it is estimated that $54,000,000 a year will be spent throughout the country for products coming from other sections.

Development of this project by 1960 will furnish homes for 1,000,000 people. Actual construction will require the services of from 4,000 to 5,000 men over a long period of years. In addition to these, many more thousands will be required to produce the steel, cement, lumber, and other construction materials, that must be bought in other localities. Later, as the project progresses, millions and millions of dollars in the form of materials for the erection of buildings, flumes, the purchase of agricultural machinery, and the creation of cities and towns will be spent to give employment to millions of workers.

With 1,000,000 increased population, and an area larger than Connecticut and Rhode Island combined, innumerable villages, towns, and cities will arise throughout the project. The district engineer of the Army in his report estimates that the settlers on this project will make annual expenditures as follows:

Hardware, miscellaneous	$1, 465, 344
Lumber	2, 412, 641
Autos, trucks, etc	10, 932, 932
Furniture	2, 482, 465
Dry goods, etc	11, 791, 320
Food	5, 960, 998
Personal service	3, 716, 020
Personal interest	3, 571, 080
Sundry	490, 600
Taxes, local	3, 000, 000
Annual payments on project	6, 000, 000
Total	51, 823, 400

This great total of almost $52,000,000 expended annually will increase production in every State of the Union. To-day I am ordering an automobile from Flint, Mich. Those of us who live in the Pacific Northwest always have and necessarily must continue to buy many commodities in the East and Mid-West.

Railroad tonnage will naturally be increased. Power will bring new industries, and on the authority of the engineer's report, I can say that without it further development will not come to the Northwest.

The Columbia River has greater potentiality for power development than any other river in the United States. Dam construction at Grand Coulee will amplify the potentiality of every power site from that point to the sea, as it will create a storage of 5,000,000 acre-feet.

The engineer's report shows that there is ample market for the power. The bill prepared by the Washington State congressional delegation however provides that no appropriation shall be available until the power is sold. It also provides that the reclamation of land shall not be undertaken until market conditions demand such action.

While it is true that approximately 1,200,000 acres will be reclaimed by this project, yet irrigation will scarcely be started within the next decade and will not be completed within 50 years. It would be short-sighted policy to forego the development because it creates new arable land. If this thought prevailed in the early development of this country and consideration was given only to land actually needed for production, St. Louis to-day would be the outpost of civilization. Furthermore opening of this area takes out of agricultural competition a vast section of grain producing territory, and substitutes therefor a highly diversified farming section.

At this point, Mr. Chairman, I desire to set forth the views of certain high public officials; and of nationally recognized experts, on the merits of this project.

President Hoover, in Seattle, Wash., August 21, 1926, when Secretary of Commerce, said:

The initiation and construction of the Columbia Basin irrigation project is inevitable. It should be undertaken at the earliest possible data.

My observations have convinced me that the Columbia Basin project should be embraced in a national program of major water improvements.

It should not be delayed until we are overwhelmed with population.

Former President Coolidge on November 17, 1927, before the Union League of Philadelphia said:

The Columbia Basin project is not far distant.

While on an inspection tour of the Columbia Basin irrigation project, August 1 to 3, 1930, the Commissioner of Reclamation, Dr. Elwood Mead, said of the general project:

The Columbia Basin project is not only feasible, but it can be done more cheaply now than it could 10 years ago.

The Columbia Basin project is not half as big as it was five years ago.

It will not be seeded to corn or cotton or wheat. There is an overproduction of those. You could grow sugar beets, garden products, and operate dairies and swine ranches most successfully.

And the expanding growth of the Northwest will provide the market for everything it grows.

At Seattle, Wash. (Post-Intelligencer), September 12, 1930, the Secretary of the Interior said:

Columbia Basin is probably the greatest undeveloped project in the West. One can not help being favorably impressed by it.

At Seattle, Wash., September 12, 1930, the Times said of Secretary Wilbur:

He regards the Northwest irrigation program, particularly Columbia Basin, as one of the most important in the Nation, he said. It has tremendous power possibilities in addition to its other prospects, the development of thousands of acres of arid land.

At Portland, Oreg. (Commerce), September 13, 1930:

He declared, that "in future reclamation, bringing arid lands into production is the outstanding value to be found in all uses of water for this region. He placed the great hydroelectric possibilities as second in importance."

Hubert Work, former Secretary of the Interior, said:

Just so 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 project.

July 19, 1930, B. C. Forbes, financial authority and publisher of Forbes Magazine, made a personal inspection of land and water contained in the Columbia Basin irrigation project.

The project fits ideally into President Hoover's plan. What a pity it could not have been ready the first of this 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.

The Columbia Basin project will pay large and increasing dividends.

Nicholas Longworth, Speaker, United States House of Representatives, said:

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 if 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.

The late Gen. George W. Goethals, builder of Panama Canal, said:

Though located in the State of Washington, the benefit from the Columbia Basin project will not be confined thereto, but will extend to all parts of the United States. Through it pace will be kept with the ever increasing demand for foodstuffs of all kinds. It required vision to conceive the project; far less imagination was needed to picture the benefits that will accrue to the entire country through its realization.

John L. Powell, at Spokane, on September 4, 1930, declared:

The Chamber of Commerce of the United States is ready and willing to indorse any irrigation project which demonstrates its economic need. It is now convinced that the Columbia Basin project has demonstrated that necessity.

There is no opposition to the Columbia Basin project anywhere.

I am quoting these views of high public officials and learned experts, just to show the great desirability of this project, as seen from the viewpoint of national figures.

It appears to me, gentlemen, that here is an excellent opportunity to solve in part the unemployment crisis. I disagree with some of the other gentlemen that it is going to be compulsory to get men back on the farm. In the past the farmer boy went to the city to seek the greater opportunity offered him there. This condition does not prevail to-day.

Furthermore, the man in the city—and I happen to be one of this type—now often wants a little ranch somewhere, with the thought of getting away from the hurry and turmoil of the city. Rapid transportation has made the city close to the country. I believe this desire for farm land is a natural sequence, and will greatly help in the development of this project.

In Seattle we have 60,000 people out of 367,000 population, who to-day are being fed through public charity, and there are many more who are just eking out an existence. These people would welcome an opportunity to cultivate the soil.

Of course, there are the more immediate benefits which would result from the commencement of construction, in the way of employment, stimulation of local business and enterprise, and those other activities I have already discussed.

Mr. Chairman, and gentlemen, thank you very much for allowing me this opportunity to tell you something of this great and wonderful project. I hope and trust it will meet with your favorable action. Thank you, again.

Mr. HILL. Mr. Underwood, we would like you to make a statement to the committee.

STATEMENT OF J. J. UNDERWOOD, REPRESENTING THE SEATTLE CHAMBER OF COMMERCE

Mr. UNDERWOOD. Mr. Chairman and gentlemen, I intended to make a longer statement, but if I may be permitted, I will put it in the record.

I would like to state, in answer to Mr. Miller, who has just left, that this project was conceived in 1919 for the very purpose that he had in mind, to put soldiers on the land, and it was made a part of the first bonus bill that passed the House and the Senate. It was reported out by this committee and by the Senate committee. It was not intended by these committees that it should be made a part of the bonus bill, but the exigencies of the situation compelled it, and the bonus bill was vetoed. Otherwise, the project would have been adopted 12 years ago.

We of Seattle who have been behind this project from its inception are interested in it, not alone because of its benefit to the people who would live upon the land but because of its effect upon foreign trade.

Let me say, first, that Seattle is a commercial city. We must build up the country surrounding it. It is a shipping city. Its shores are washed by the Pacific Ocean. The lands contiguous to the Pacific contain two-thirds of the raw material of the earth and three-fourths of the people of the earth to-day.

Now, while it is true that commerce generally has declined, the commerce of the Pacific Basin has not declined in proportion to that of the other parts of the world; and so far as the talk of flooding the eastern markets with these products is concerned, let me say this: Three years ago—and we made a check of this very carefully, when farm relief first was under consideration—and we found that we shipped over our docks that year $39,900,000 worth of apples and pears going intercoastal, to northern European points and to the Orient. Scarcely 10 per cent of that went into the United States. We have 17 lines of ships. I am talking about lines, not ships. They run out of Seattle to-day, carrying cold storage, and in every restaurant in the Orient, and in every hotel in the Orient, you will see advertisements, "We are selling American food products," or "American vegetables." Five big liners run out of Seattle—I am talking about the Dollar Line—carrying 500 tons of cold-storage space. That is expensive space. At first we had to fill it with flour and lumber and cheap freight. I would like to see you try to get a contract on some of that space to-day; it is contracted a year and two years ahead.

I have just checked up some recent figures on this situation. In 1913, the international commerce of the industries of the Pacific Basin aggregated $6,000,000,000 and constituted 14 per cent of the total of the world trade. By 1929, when the total of the world commerce had grown from $40,000,000,000 to $67,000,000,000 the proportion held by the countries of the Pacific Basin had expanded from $6,000,000,000 to $14,000,000,000. The great expansion is on the Pacific area. I have other figures here, but I will not take the time to go into them, but they show a general increase even in these

times of depression. While it is true that there has been a decline in the dollar value, there has been only a slight decline in tonnage. That simply means that the commodities are now selling at less than three years ago, due to the decline in silver, the depreciation in foreign currency, and other reasons.

Four great transcontinental railroads were built in to Seattle. The gentleman who built those railroads, who conceived them, had in mind the great trade of the Far East.

That region between the mouth of the Columbia River and Prince Rupert, we will say, which is 500 miles or 600 miles north of Seattle, is the closest point of contact between the continent of America and the countries of the Far East. Commerce naturally will flow eventually by the shortest course, and that accounts, in a large degree, for the statement made by Mr. Horr that this city, built and founded only about 80 years ago, when the first white people ever saw it, is now a city of approximately one-half a million people.

The CHAIRMAN. Well, now, you spoke of certain interests, I believe you said in the East, that perhaps objected to this development, because it might be in competition with their interests. You stated, however, that that country need not be apprehensive, because this would not be in competition with them.

Mr. UNDERWOOD. Yes.

The CHAIRMAN. Do you not think that the spirit of selfishness in this country, when one group of people have opposed projects because, perhaps, in some way, it might be competitive—that that would also have a small influence upon present conditions.

Mr. UNDERWOOD. I do. I quite agree with you.

Mr. HORR. Do you not think that we have, even to-day, in this country, that we must gather around and take care of America, without any spirit of rivalry or jealousy——

Mr. UNDERWOOD. I quite agree with you, sir, but I made that statement because of the announcement made by the Secretary of Agriculture some time ago, opposing the development of the Columbia Basin. I can not recall just when it was, but I can find it and put it in the record, if you want me to. That was the reason that I made that statement.

I think, gentlemen, I shall not take any further time.

The CHAIRMAN. Any questions, gentlemen? Do you desire to have your written statement incorporated in the record?

Mr. UNDERWOOD. I would like to make a written statement in the record.

The CHAIRMAN. You may revise it and give it to the reporter.

Mr. HILL. Mr. Chairman, I take it that you would like to adjourn now?

The CHAIRMAN. Yes. Now, Judge Hill, will you give the committee the names of the gentlemen who you will present to-morrow?

Mr. HILL. To-morrow, we have Mr. Gill, who will make a very brief statement, but comprehensive; Senator Jones, possibly Senator Dill, Congressman Summers—and Congressman Summers, I want to say, is vitally interested in this project, because most of it lies in his district, and no doubt he will cover the subject in a very informative and comprehensive manner; and then we have Congressman Hadley, who will make probably a brief statement, and that is all.

The CHAIRMAN. Do you think that we can conclude the hearings to-morrow?

Mr. HILL. Yes; no question about it.

I want to again express my appreciation to the members of the committee, and if you will be patient with us for one more day, I think we will conclude.

The CHAIRMAN. Very well, the committee will stand adjourned until 10 o'clock to-morrow morning.

(Whereupon, the committee adjourned, to meet at 10 o'clock a. m. on Friday, June 3, 1932.)

THE COLUMBIA BASIN PROJECT

FRIDAY, JUNE 3, 1932

HOUSE OF REPRESENTATIVES,
COMMITTEE ON IRRIGATION AND RECLAMATION,
Washington, D. C.

The committee met pursuant to adjournment, at 10 o'clock a. m., in the committee room, No. 333 House Office Building, Hon. Robert S. Hall (chairman) presiding.

Present: Representatives Hall (chairman), Cross, Fulbright, Arentz, Chavez, Overton, Martin, Leavitt, Swing, Butler, and Loofbourow.

The CHAIRMAN. The committee will come to order, and we will resume the hearing.

Mr. HILL. Mr. Chairman and gentlemen of the committee, I want to present Senator Wesley L. Jones of the State of Washington, who will make a statement on the Columbia Basin project.

STATEMENT OF HON. WESLEY L. JONES, SENATOR FROM THE STATE OF WASHINGTON

Senator JONES. Mr. Chairman and gentlemen of the committee, while I think it is unnecessary for me to attend before the committee in regard to this bill, I am glad to do so. I know that you have heard not only from the engineers with regard to this proposition, but from other members of our delegation and others of the Reclamation Service, who are fairly familiar with the situation. I can not really hope to add anything to your knowledge as to what this project means.

I think it is the greatest irrigation project in the world; it is the greatest project in the United States, anyhow, and I do not know of any other project even in the world that compares with this one in any way.

Now, I am fairly familiar with the country involved. The Yakima Valley borders this territory, and I lived there for twenty-five and odd years, myself, and I know the development of irrigation, especially in that section, from personal contact; it is one thing in my congressional career—and I hope you will pardon me for referring to it—that I take as much pleasure in as anything, and that is the fact that while I was in the House I had the pleasure of representing the State of Washington on a committee of seventeen that was working out the reclamation problem, the reclamation act, and to that extent I had a part in the actual development of the act of 1902; so that, in a legislative way, I have been connected with it.

I have seen that development in the Yakima Valley grow from two or three thousand acres into the development that we now have. I have kept track of the reclamation development throughout the country, generally, and I take a great deal of pride in it.

It is not necessary for me to tell you what reclamation does, but there may be some who read the record sometimes that are not familiar with reclamation work. When I went to Yakima—and I do not know that I can illustrate this any better than by just the personal knowledge that I have of the development. When I went to Yakima some forty-odd years ago, there was just a little irrigation there, only two or three thousand acres. In fact, I did not think that there were that many acres reclaimed at that time. At that time, it was thought that the lower lands were really the best lands, but it was not long until it was found that really the higher lands were more valuable. Many acres of the lower lands seemed to be going to alkali, and some of the lands that were in alkali at that time are in alkali to-day, the lower lands. Irrigation got its work in, and after the lands were irrigated, it was found that the most valuable, the most desirable for irrigation purposes, and for other purposes, were the higher lands.

Now, reclamation means just what it says: It means reclamation. Lands that are irrigated are really reclaimed from the desert, and they are the most productive lands that we have. They are more productive, I think, than the lands in the East, because we are certain of "rain" whenever we want it, that is, if we have the water, and irrigation has not been carried on in the Yakima Valley except when the water was available, and it has generally been found to be sufficient. There have been some times when there has been a little shortage of water, yet, with the most careful irrigation, we have had water at all times, whenever we wanted it. Subsequent conditions show the value of that, because there is no failure of crops when there is ample irrigation.

There may be some little shortage in the upper crops, for instance, but it is not because of the lack of water, but it seems to be the nature of those trees not to bear some years as much as others.

So that the lands around in the Yakima country originally were what we might term waste lands, that is, they were unproductive, and they could not produce anything, until we got the water, so that irrigation reclaimed what was otherwise waste land in this country, and especially in this western country does it do that.

Now, what has been the result of irrigation in the Yakima Valley? I referred to that because that simply demonstrates what we may expect from this project that we are so much interested in.

Yakima City was about 800 people when I went there.

Mr. MARTIN. What year did you go there, Senator?

Senator JONES. 1889. Now it has 25,000 people, with a population corresponding in the country around. What brought that about? Nothing but irrigation. We have not a manufacturing establishment. We have no manufacturing there to develop, or anything of that kind. It has come about entirely as the product of reclamation and irrigation. While we had in the valley only two or three thousand people at that time, 175,000 or more people now are there, depending on irrigation as the foundation of their prosperity.

Now, what does that do? It not only brings population, but it brings wealth and property value increase, and there is a development along every line of industry. We raise thousands of dollars in taxes now to help defray the expenses of the county and State government, and the payment of income taxes, and the taxes that the Federal

Government necessarily has to impose. They are met in that proportion in that valley. That is one of the fundamental resources in that section, not only for State and county purposes, but also for the National Government; and when the war came on, we had many boys who furnished fighting men at the front.

So that reclamation has developed the country, as a whole, probably more, I think, than almost any other similar section of the country that was undeveloped 45 years ago.

Now, as I look at what we did in the Yakima Valley, including the Ellensberg section and the Wenatchee section on the Columbia River, we can do with every foot of this land known as the Columbia Basin project.

You have had pointed out to you, of course, what the size of that project is. Instead of 175,000 acres, it will probably be a million and a half acres.

Now, this territory is exactly the same as the Yakima and Wenatchee Valleys; it has the same kind of soil, the same fertile and productive soil, it has practically all kinds of climatic conditions that are found in the Yakima and Wenatchee Valleys; so that we have every reason, I think, to justify us in the belief that the development of that great territory will be substantially the same, in years to come, as the development in the Yakima and Wenatchee Valleys.

I think I might refer to the climatic conditions, because some of our people in the East, at least, especially those who have never been there, may have an idea that is not correct with reference to climatic conditions.

It is away to the north, of course, but it is not correspondingly cold. In Yakima Valley I have noticed that, for many years, spring generally opens about two weeks before it does here in Washington City, and we know this: That in the southern part of the Yakima Valley spring opens about two weeks before it does about Yakima, and Ellensberg is later than Yakima, because it is higher, but there is practically the entire possible range of climate in this territory that is embraced in this Columbia Basin project from really, we might say, the Torrid Zone to all classes of the Temperate Zone.

Take it in the southern part: They may not raise oranges, or things like that, but every possible product of the Temperate Zone, practically every phase of production in the Temperate Zone, can be produced in abundance in this territory.

Take fruit of all kinds, and take hay of all kinds, alfalfa, dairy products; practically every class of Temperate Zone production can be produced in this section of this territory in abundance, and there will be production every year. We can never expect any failure of crops. We have had no failure of crops in the Yakima Valley since I have been there, and I have been there until now, and we need not expect any in this territory.

We can very properly judge this territory by the Yakima territory and the Wenatchee territory, and I think we can very confidently expect—maybe not in my time or yours—a population of 1,000,000 people in that territory. Now, that means wonderful consumptive uses.

The people of the East expect us to compete with them by the development in this territory. They may be afraid of competition that comes from it, but I think there is no basis for that fear. I think,

on the contrary, there is no better market, or more substantial market, for the industry of the East, than in these agricultural developments that have already taken place, and we can expect the very same thing to take place, only to a far greater extent, with reference to this project.

Doctor Summers has heretofore, practically, before your committee, gone into details and given the products of the East that have been brought out to the people of the Yakima Valley. My recollection is that there were thousands of dollars of manufactured products of the East sent out there.

Now, we can expect the same thing throughout all of this territory, only to a much larger degree, that will be of substantial benefit to the East as well as to the West.

I frankly say that I hope to see the development—no; I do not hope to see it, but I hope that development will come—in that western country, such as to lead to the development of manufacturing plants out there to supply largely the local demand; but it will be many, many years before it comes, if it ever does come, because the manufacturing plants have such a substantial progress and development in the East that we will have hard work catching up with them. But we take every manufactured product of every kind and character.

How about competing with them in their productions outside of manufacturing? There is no substantial competition in agricultural products with the eastern country from the Yakima and Wenatchee Valleys. As a matter of fact, they supply largely the products that we do not have enough of for our people in the East. There has been a great development in fruit, but it has not brought any special competition with the fruit industry of the East. I think our competition, if competition does come, will come largely from the advanced methods that we have developed in the way of handling fruit and taking care of it, and the kind we produce, the magnificent kind that we produce.

As I say, we may expect just about the same condition of things from the development of the Columbia Basin project. They will consume a large percentage of what they produce themselves; it will be consumed on the ground by the people of the cities and towns and villages that are bound to come up, so that what may be left over, the surplus that we will have, will be comparatively small, and it will not compare with the demand that we will make on the Eastern and Middle Western country for the products that they are producing.

So that, as I look at it, instead of the development of this project being injurious to the people of the East and the agricultural production of the East, it will be a substantial benefit and advantage; and, as I say, it will furnish a market for many of these eastern products, it will furnish the employment of labor and the employment of capital, and so on, that will far overbalance any competitive condition that it might possibly bring about with the people of the East.

Now, there is just one or two more questions that I want to bring out. They have probably been brought out before your committee.

One is the employment of labor in the construction of this project. Some people seem to think there is contemplated a development of the project whereby production under it will be possible within a year or two; there is nothing of that kind possible. As has been shown

to you, we can not cultivate an acre of land inside of 10 or possibly 15 years; it will require the construction of a large dam in the Columbia River, and that, no doubt, has been explained to you, and it has been pointed out to you that it can not be completed, probably, before 10 years, and after it is completed, it will take quite a time to get the water through the irrigation canals to the part of the land that is to be reclaimed. So that, as I estimate it, and I base this on the experience that I have had in the irrigation country, there will be no substantial production, therefore, on this project, of agricultural products, inside of 15 or 20 years, and no large production inside of a much longer time.

Take, for example, the Sunnyside Canal, in the State of Washington, in the Yakima Valley; that was opened up, my recollection is, in 1891, 40 years ago, irrigating about 100,000 acres of land. There is some part of that land that is capable of irrigation that is not reclaimed yet. Irrigation development is a slow process, comparatively slow. Now, from that I think we can pretty well judge how this territory is going to be developed. It will not be developed overnight by any manner of means. Now, while this dam is being built, there will be a large force of men employed, not only directly upon it, but also in connection with the furnishing of materials that will come from different sections of the country, to be used in the dam.

So that, from every possible standpoint, it seems to me that it is most desirable that this project should be approved and put in operation just as soon as possible.

Now, there is a provision in the bill that no money shall be appropriated until all of the power that will be developed by this great dam will be contracted for. We can confidently hope that in the near future—that is, of course, it will be a long time compared to Senator Dill's time and mine, but it will not be very long until that power will be consumed, and the proceeds from it will go a long way, if not entirely, toward really defraying the expenses of the dam, and a great deal of the expenses of the proposition itself, of the actual irrigation.

So that, from every standpoint, it seems to me that it is very desirable for us to start this project just as soon as possible, and by that, I do not mean the actual construction, but I mean to put it in shape so that the conditions that are imposed upon us may be met. As I said, the condition is imposed by this legislation, that no appropriation can be made until contracts for power are made. It is impossible for us to contract with the people for this power until this project is authorized, because there must be some basis for people to engage in contracts of that kind.

So that it seems to me that there is every reason in the world, from an economic standpoint, from a practical business standpoint, from the interest of the people, from every possible standpoint, in favor of adopting this project just as soon as possible, so that the necessary work, which will probably take 2 or 3 or 4 or 5 years to get in shape before any money is appropriated, may be done.

That, gentlemen, in a rambling sort of way, is about all I care to add to the record that has been made.

It is, of course, of tremendous importance to the State, and it is of tremendous importance to the people of the country; it will develop that power, and it will ultimately develop homes for many, many people of this country that have been looking for homes of that kind,

and the more they become familiar with reclamation and irrigation work the more anxious they will be to settle in that territory.

I thank you, Mr. Chairman.

Mr. HILL. Thank you, Senator Jones.

The CHAIRMAN. Senator, we certainly thank you.

Mr. HILL. Mr. Chairman and gentlemen of the committee, we have also Senator Dill, of Washington. I want to present Senator Dill at this time and ask him to make a statement to the committee.

STATEMENT OF HON. C. C. DILL, SENATOR FROM THE STATE OF WASHINGTON

Senator DILL. Mr. Chairman and gentlemen, I do not want to rehash and repeat what has been probably told you several times, in addition to what Senator Jones has said.

I have one thought to give expression to, in connection with this proposal. It is such a large proposal, and it proposes the Government shall expend such a large sum of money in our section of the country, that I think it is well to remember that we are not asking for anything so unusual, after all. The Federal Government has built a great dam at Muscle Shoals, which has caused us a lot of trouble, but it has not been due to the law under which the dam was built, for the Government could go ahead and operate it without any additional legislation whatever, if it wanted to; but the trouble has been that those in charge of the Government have wanted to turn it over to private interests, and they must have legislation before they can do that. But I mention that as one of the great precedents for this kind of proposal.

Then we have the proposed great dam, or the building of a great dam, in Boulder Canyon, on the Colorado; and we have provided by authorization an immense amount of money for protecting the lower Mississippi Valley, and that is even bigger than this proposal; and these three particular big proposals seem to me to justify us, who live in the far Northwest, to ask the Federal Government to consider our proposal, which is so big that it can not be handled by any State or small organization.

I can not refrain from reminding you, also, that the authorization of several hundreds of millions of dollars for the protection of the lower Mississippi Valley is an expenditure of money that is to be made to keep the water off of the land, none of which it is proposed to ever repay the Government. We voted for it; we conceived it was a wise policy; and we expect to vote for the appropriation to carry it out.

I mention these things to show what I deem to be our complete harmony with the series of precedents which have already been set by the Government.

Now, there is another thought that came to me as Senator Jones spoke, about agricultural lands. I note, in the last election in the State of New York, there was a big contest before the people for the reforestation of certain lands there. I have learned their plan is to buy up lands amounting to literally hundreds of thousands of acres, if not millions of acres of land, that is now so poor for farming purposes that the people living on it can not make a good living. It is proposed that the State buy that land and place it in forests, that is, reforest it.

You know, as well as I do, that practically every year we are compelled to authorize loans on farms, on a lot of dry land, some of it in my State, some of it in Montana, some in the Dakotas, and it becomes so common that I think we are all convinced that unless we have an unusual increase in rainfall, those lands must ultimately be abandoned, because the Government can not go on continuously financing farmers who live on these lands. In other words, by the time this proposition is ready to develop, there is going to be a need for land, owing to the abandonment of the farm lands that are now on the borderline of producing enough to justify people living on them.

Then there is another thought that I want to express:

This country that will be developed by this great dam is close to the Orient and we are at the threshold of development of the Far East. The agricultural products which must be carried any great distance, soon accumulate such charges that it makes them extremely expensive to the people who buy them.

This country lies so comparatively close to the Puget Sound area, from which shipments go to the Orient by a shorter route than any other part of North America, that by the time this country is developed, it seems to me there will be a tremendous market for the products of this land in the Far East that no other part of North America can supply so readily as this section can. So that it seems to me that we need not have any great fear from the standpoint of what will be done with the production, and I am extremely glad that this committee has gone ahead with these hearings, and I hope that, when you will have completed them, you will find it within your judgment to report this bill favorably, and we hope to do a similar thing in the Senate, and that we can get this project authorized.

It is such a big affair and it will take so long, that we are anxious to get it started.

I have not gone into the history of it, but it is all covered, I am sure. I have not gone into the reports regarding it, because I do not want to take any more of your time.

I appreciate the opportunity of saying these few words to you; and my principal purpose in coming here was to express my deep interest in this matter, in the hope that the result will be a favorable report on the bill.

The CHAIRMAN. Senator, we thank you for your illuminating statement.

Mr. HILL. Mr. Chairman, I would like for Congressman Hadley to make a statement to this committee on this bill.

STATEMENT OF HON. L. H. HADLEY, A REPRESENTATIVE FROM THE STATE OF WASHINGTON

Mr. HADLEY. Mr. Chairman and gentlemen, I am grateful for the opportunity to appear very briefly and most informally. I know that you have been in session for some time. I think I was here the morning the hearings began, but I have been unable to come in at any time since, because my committee has been meeting daily also on matters of vital importance, and is now in executive session, and I am due there.

Therefore, I must conclude what I say within a very few moments.

If I could paraphrase or repeat the last sentence of Senator Dill's statement, I would express the reason why I am here, and my interest in this subject. I heard almost all of the statement of Senator Jones, but not quite all of it, and all of Senator Dill's, and from the viewpoint of those men who represent the State, in the aggregate, I think their statements cover the basic facts in the whole case. Of course, they might be enlarged upon in much detail, as you all know.

I assume that the hearings have developed the questions of feasibility thoroughly, and the economic phases of the question presented by the bill. Therefore, I believe it would be useless, on my part, to restate those matters, or to discuss them.

All we are doing is supplementing the record by the expression of our vital interest in this subject, and it is an old one with us in the State.

I come from the northwestern portion of the State, and am not in immediate contact with this area, speaking by way of physical geography, because the mountains intervene; the people on the west side of the State, I know, are as deeply interested in this question and the furtherance of the project as the people on the land embraced within the proposed project.

Now, Senator Dill spoke of the fact that the contracts must be made before the money is spent. This is a practical situation which ties up the enterprise in such a business way that it can not be said that it is in any way speculative. There is a guaranty in the framework of the proposition in the interest of the Government and the people alike.

Of course, the population of the Pacific Northwest is comparatively sparse, and yet I have seen it multiply several times. I saw Seattle first when there were but 43,000 people there, and now, with its contiguous territory, it has multiplied ten times, approximately, and that is relatively true of many portions of that State, and it is relatively true of the Northwest and the Pacific coast, generally.

This committee, by reason of its jurisdiction and study of reclamation has long been an agency for the development of the States and sections of the country requiring reclamation. I need not point out the particular feasibility and importance of that line of cooperation.

Senator Dill has referred to certain geographic, basic developments, and this is another one. If you look at the geography of the country, and have regard for what has been done in this way, we see at once a great section of the United States would be tributary to this great development, which has not been afforded that opportunity heretofore.

I know the story of the people in eastern Washington on this land, and in its vicinity; I know their courage, their hope, their faith, their tenacity of purpose, and the story is really pathetic. I will not state it here, because I presume you have heard it; and they are waiting with this hope.

As we say, "hope springs eternal in the human breast," and we hope for some definite action to put this project under way, because we know how many years it will take to realize upon a problem of this magnitude. No money will be spent until the necessary preliminaries have been effected, and by that time we hope that conditions will be such that neither the Government nor the people at large will feel it.

In any event, we do know that the Pacific coast and the Northwest are at the end of the trail, and if there is anything that this country needs to-day more than anything else, it is a general dispersement of

its population, and its distribution in such a way that it may be afforded an opportunity to live, to live properly and happily, and to decentralize the great masses of the people which are accumulated, and have been for many years, in our great cities. That is, undoubtedly, one of the basic difficulties that underlies the immediate situation. This is a movement in the direction of decentralization of population, under a vast project which will accommodate, as has been pointed out, many, many people, and they will come as fast as the development affords them the opportunity to realize a livelihood.

I do not think it is necessary at all to take up the question in its every detail. I just want to say that I trust the good judgment of this committee, and that I will be perfectly satisfied with whatever it may do in the premises; but I do wish to urge the favorable consideration of the committee on the pending bill, and your cooperation in bringing forward a proposal here which will do so much toward developing a great section of the country; and I think it is just as obvious as anything can be, that there is here a matter of mutuality between the east and west.

Reference was made to the distribution of commodities and the output and consumption of the east and west respectively. You are familiar with those figures. I would not be here to urge a sectional development of this magnitude, if I thought it was not to the advantage of the whole country; I would not encourage it, or ask for it. We ask for small distributions of Government funds in the matter of small enterprises throughout the country, in common justice to all sections, when Federal cooperation is extended; but when it comes to a gigantic enterprise of this kind, I realize that there must be national consideration of the subject, from a national standpoint, and your record will undoubtedly disclose advantages to flow to all sections of the country, as well as to this.

There is national need for this opportunity to further disperse our population in a way that will accommodate pro tanto the people of the nation, generally, and I do not know of any other place in the United States that affords such an opportunity of expectation in that regard, as the premises on which this bill is predicated.

I must go now to my committee meeting. I thank you for the opportunity of coming in here to express my interest and sympathetic attitude toward the legislation.

The CHAIRMAN. Mr. Hadley, we appreciate your statement.

Mr. HILL. Mr. Chairman, Congressman Summers is, of course, interested in this, as are all of the Members of the congressional delegation of the State of Washington; but, in addition to that, I may state that he has a perculiar, direct interest, for the reason that the lands largely lie in his district. I want to ask Doctor Summers at this time to make a statement.

STATEMENT OF HON. JOHN W. SUMMERS, A REPRESENTATIVE FROM THE STATE OF WASHINGTON

Mr. SUMMERS. Mr. Chairman and gentlemen, first, I want to express my appreciation to you for coming here day after day to hear our story of the Grand Coulee power project, one of the great developments that is to take place in the Pacific Northwest.

I would like to call the attention of new members here to the fact that, for several years, I sat as a member of this committee. And while we had many projects to consider, after all, the thing that stands out in my mind is the very early hearings on the Boulder Dam project, which were held by this committee during the years when I was a member, and I shall always look back upon that as something really worth while in my congressional career.

The thought I have in mind is this: That the town council will handle the spring branch that runs through the town, but the members of this committee to-day are dealing with one of the greatest undeveloped national projects to be found within the confines of the United States, and the consideration that you give this bill now before you and the favorable action we hope you will take, you may always look back upon as being a real constructive move in behalf of the whole Nation.

This project lies in the central eastern part of the State of Washington, but it transcends the limits of that State. This is truly a national project. I think General Goethals said it would mean more to the United States than the Panama Canal.

I want to bring out, in the very beginning, that we are not asking for a donation of any kind from the Treasury of the United States. We are discussing here a project which proposes to repay its cost, with 4 per cent interest, and that within 30 years.

I am now addressing myself to that part of the project which really is before us at this time, that is, the power project, because that is the project that is to come within the first 20 or 30 years.

THE GRAND COULEE POWER SITE

The United States Army Engineers have told you, that at the head of the Grand Coulee, on the Columbia River, is the greatest undeveloped power site in all the North American Continent. The United States Reclamation engineers, the Secretary of the Interior, the Director of the Budget, and the President of the United States concur in their findings.

This was emphasized by Col. Hugh L. Cooper, who is, perhaps, one of the world's best known constructors of hydroelectric power dams, thoroughly familiar with power sites throughout the country.

These statements were made by these engineers after years of investigation. The water supply is constant and unlimited. The Columbia River has its source in the very heart of the Canadian and American Rockies, in the glaciers, and is augmented by the heavy snowfall and rainfall; and the great run-off comes not in the early spring, but rather toward midsummer; so we have, to start with, an unsurpassed and dependable water supply that reaches its maximum when most needed. Nobody questions that. It is several times beyond what will ever be required in the development of the great features of this project; and underlying the Columbia River, at the point where the dam is proposed to be constructed, nature has placed a bed of granite on which the dam may be constructed. The engineers tell us that a dam 4,000 feet long and 400 feet high, will prepare the way for the establishment of a power plant unequaled any place now, or at any time in the future, on the North American Continent.

I think we might well ask ourselves this question: Is this water to run on to the sea throughout the ages, serving man in no way, or shall we begin to take advantage of this great natural asset?

In a speech I made on reclamation years ago, which I called, "Jack Rabbits and Markets" I traced the sagebrush plains. To-day I trace this water power, which was there, unused, when the white man first stepped on the American Continent, and throughout all of our colonial development, the Revolutionary War, the Civil War, and on down, and not one cent has been derived for the people of the Northwest, or the East, or any other part of the country, from these great resources. We believe the time has come when we should look forward to the development of this great project.

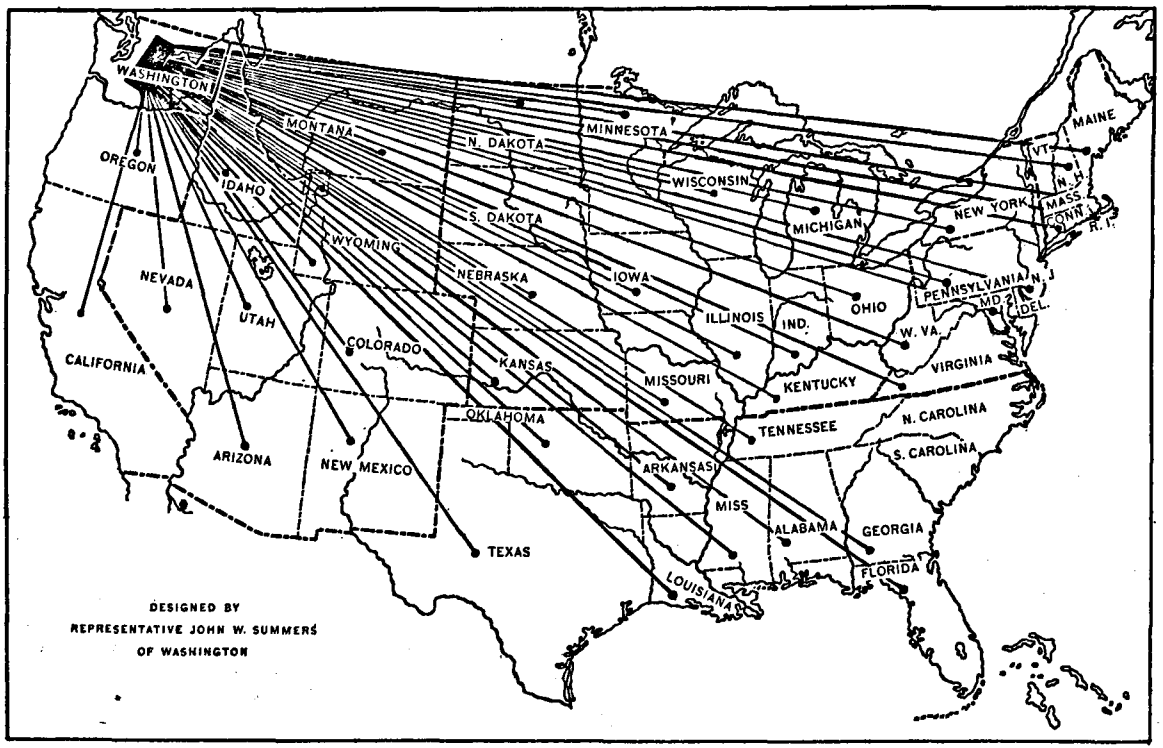
SAGEBRUSH AND MARKETS

Colonel Cooper told you that, with this development, Washington could be and would be one of the greatest and wealthiest States of the Union. Is there going to be any jealousy? Are we jealous of the fact that New York is a great metropolis and the commercial and financial center that it is? Are we jealous of the fact that Illinois came along, and out of a wet, soppy, prairie, half covered with frog ponds, has developed into one of the greatest States in the Nation? Is it a detriment to New York that Pennsylvania has developed as a great manufacturing State, is it a detriment to Massachusetts? Not at all. Will it be a detriment to any State for the State of Washington to finally pay ten times the income tax it now pays?

We have to get a national viewpoint on this thing; we have to get a vision that obliterates State lines. We have to see its benefit from ocean to ocean and from Canada to the Gulf. Only by the vision of her statesman can any nation become great.

I tried to illustrate what reclamation projects mean to the whole country when I drew this map [see page 208], which shows two irrigation projects out in the Northwest. Each line here runs out to the States that shipped carloads, or multiple carloads, of their products into these irrigation projects. There is not a State in the Union but what directly benefits from a development of this kind. Seventy thousand cars of manufactured goods of every kind and description from farms and factories are now shipped from every State in the Union into two reclamation projects in the State of Washington annually. Without reclamation not one train of these products would be shipped to these sagebrush areas.

Let any man who questions the value of western development trace to the source these 70,000 cars of outside products that were shipped



Origin by States of 70,000 carloads of goods shipped into two projects in Washington State during 1929

by rail in one year into two reclamation projects in the State of Washington:

Carloads shipped into the Yakima and Wenatchee projects in one year

Arkansas	319	Missouri	1,439
Arizona	989	Maryland	1,623
Alabama	179	Minnesota	859
California	23,296	New Mexico	1,936
Colorado	513	Nevada	326
Connecticut	279	New Hampshire	2
North Dakota	17	New York	997
Georgia	21	New Jersey	883
Florida	1,395	Nebraska	381
Iowa	360	Oklahoma	1,293
Illinois	3,620	Ohio	631
Indiana	462	Oregon	1,479
Idaho	2,140	Pennsylvania	1,388
Kentucky	154	Rhode Island	73
Kansas	1,285	Texas	2,981
Louisiana	616	Tennessee	96
Maine	19	Utah	1,062
Massachusetts	120	Virginia	4
Michigan	5,935	Wisconsin	1,143
Mississippi	134	Wyoming	7,918
Montana	957	West Virginia	27

POWER AND MARKETS

As I stated, the power development, the unlimited power, engineers have told us, by far exceeds what is produced, or can be produced, under any conditions, at any other place in the United States and at half the cost. We have near by a great storehouse of timber, which ought to be manufactured, instead of being shipped throughout the world in its raw state. We are surrounded by mines, we have agricultural products, we have the raw materials that are necessary in order to utilize that power.

What is going to become of the manufactured product?

We are facing the Pacific Ocean, and the Pacific faces about three-fifths of the population of the globe, and water transportation is the cheapest transportation. Japan has been, of all nations of the earth our third best customer, and still Japan is a small nation in comparison to China or India. So we have, in three of those countries over there, six or seven hundred million people that furnish a potential market for the products that can be manufactured here. What does that mean to our people further east? In some of the speeches that I have made on reclamation, I called attention to the fact, statements made after careful check, that 50 cents out of every dollar produced out in our country very promptly rolls down the eastern slope of the Rocky Mountains and is distributed across the Mississippi Valley and all the way on to the East.

So whatever we do in the way of creating foreign markets out there, is to the benefit of the whole country.

THE PLAN

Now, I could go on with the development of power indefinitely. I do want to call attention to the figures that were given here in your presence by Colonel Butler and, preceding that, the statement of

Doctor Mead that, from the time this authorization is passed, the preparation of the final details for the construction of the dam, and the contracts for power, which must be secured before any money is ever appropriated, about five years would pass, and then Colonel Butler said about $7,500,000 a year would be necessary for the first three years after that. So it is eight years from this date before any considerable sum is called for, even in the way of a loan. During construction, about eight years from now, $31,000,000 would be the most that would be requested in any one year, in order to carry out the plan as the engineers have outlined it to you. Not a gift, understand, but a 4 per cent loan.

When the dam and power plant are constructed, and the power is sold, then comes the development of that wonderful body of fertile land, with one of the best climates for farming and living of any that I know of in all the United States, and I have studied agriculture in 47 out of the 48 States of the Union. This a white-man's farming country.

For the family that may want to go on the land and make their home there, rear their children, I know of no place in the whole United States, taking the 12 months through, year after year, that would surpass this.

The soil is productive; the water, as we have said, is abundant. Highways are ample; five transcontinental railroads traverse the tract. But it is not proposed to put this land under water, not even a small body of it, short of 20 years.

Our people are in a tragic condition out there. My heart aches for them. As far as that is concerned, they would like to have the development immediately. However, this is so stupendous that engineers and economists say that is impossible.

So we must consider the proposition from every angle, and we must say, frankly, that only an area the size of the District of Columbia, probably, would be put in cultivation in a period of 20 years, as Doctor Mead and some of the others have said. In succeeding periods after that, small areas would be added to it as economic conditions warrant, so that the complete and final development of this project extends far into the future. But I do not want this committee to delay, and I am sure this committee will not hesitate to take action on the bill now pending, because of the great time involved.

Only by the vision of Thomas Jefferson do we have this great stretch of western country. It was not to be developed in his day, but some one had to look ahead, the man of vision was the sage of Monticello. So it is in the development of a project of this kind. It is the privilege of this committee to display real statesmanship; to do some planning, some real planning, for future generations.

The CHAIRMAN. We thank you, Doctor, for your statement. Now, Judge Hill, we will proceed with the hearing.

Mr. HILL. Mr. Chairman, we have one more witness, Mr. Gill, Mr. Roy Gill, the representative of a volunteer organization or association in the Pacific Northwest, known as the Columbia Basin Irrigation League. Mr. Gill has given years of study to this project, and has a rather brief, but comprehensive, statement, that he desires to make to the committee this morning.

STATEMENT OF ROY R. GILL, CHAIRMAN OF THE COLUMBIA BASIN IRRIGATION LEAGUE, SPOKANE, WASH.

Mr. GILL. Mr. Chairman and gentlemen of the committee, my name is Roy R. Gill, a wholesale hardware merchant from Spokane, Wash. I am chairman of the Columbia Basin Irrigation League, a voluntary organization of citizens from the States of Montana, Idaho, Oregon, Washington, and other parts of the United States, organized in June, 1922. There are no dues or initiation fees and all contributions are voluntary.

It is supported by subscriptions from farmers, Grange organizations, chambers of commerce, business men, labor organizations and others.

The officers and trustees are as follows: President, J. A. Swalwell, vice chairman, First National Bank of Seattle, Wash.; vice president, W. F. Jellison, vice president Flathead County Farm Bureau, Columbia Falls, Mont.; vice president, C. C. Colt, vice president First National Bank of Portland, Oreg.; Compton I. White, president White Delf Mining Co., Clarks Fork, Idaho; vice president, Frank W. Hull, manager, Olympic Hotel, Seattle, Wash. Executive committee: Roy R. Gill, chairman; Compton I. White, Idaho; James M. Kyle, Oregon; W. F. Jellison, Montana; V. H. Elfendahl, Washington.

I have here a list of the trustees which I ask may be printed in the record.

(The list referred to is here printed in full, as follows:)

COLUMBIA BASIN IRRIGATION LEAGUE

TRUSTEES AT LARGE

Ralph W. Budd, president Chicago, Burlington & Quincy Railroad, Chicago, Ill.
Charles Donnelly, president Northern Pacific Railway Co., St. Paul, Minn.
Carl R. Gray, president Union Pacific system, Omaha, Nebr.
Henry A. Scandrett, president Chicago, Milwaukee, St. Paul & Pacific Railroad, Chicago, Ill.
W. P. Kenney, president Great Northern Railway Co., St. Paul, Minn.

HONORARY TRUSTEES

Asahel Curtis, photo artistry, Seattle, Wash.
L. C. Gilman, vice president Great Northern Railway, Seattle, Wash.
Mark Reed, lumbering, Shelton, Wash.
E. F. Benson, care of Tacoma Chamber of Commerce, Tacoma, Wash.
Charles Hebberd, president Tull & Gibbs (Inc.), Spokane, Wash.
Ralph D. Nichols, city councilman, Seattle, Wash.
Arthur D. Jones, president Arthur D. Jones & Co., Spokane, Wash.
Victor H. Elfendahl, vice president Skinner & Eddy Corporation, Seattle, Wash.
Robert E. Strahorn, railway builder and executive, San Francisco, Calif.

ACTIVE TRUSTEES

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J. J. Donovan, vice president Bloedel-Donovan Lumber Mills, Bellingham.
Fred A. Adams, president Adams Printing Co., Spokane.
Lloyd Miller, Farm Lands, Sunnyside.
Joshua Green, Peoples' Bank & Trust Co., Seattle.
Frank W. Hull, manager Olympic Hotel, Seattle.
M. G. Tennent, president Tennent Steel Corporation, Tacoma.
Roy R. Gill, merchant, Spokane.
Charles F. Stinson, president Western Grain & Seed Co., Pasco.

William M. Clapp, attorney, Ephrata.
Guy L. Anderson, president Longview Chamber of Commerce, Longview.
Joseph A. Swalwell, executive vice chairman First-Seattle Dexter Horton National Bank, Seattle.
Samuel H. Hedges, president Puget Sound Bridge & Dredging Co., Seattle.
Robert Moody, vice president First National Bank, Everett.
Frank N. McCandless, investments, Tacoma.
A. M. Tourtellotte, cashier Security State Bank, Newport.
Col. W. W. Robertson, publisher Yakima "Herald", Yakima.
Frank W. Shultz, president Commercial Bank & Trust Co., Wenatchee.
E. F. Blaine, orchardist, Grandview.
Frank M. Lowden, farmer, Walla Walla.
Hill Williams, publisher, Pasco.
J. E. McManamon, postmaster, Othello.
C. H. Brittenham, attorney, Lind.
W. N. Rosenoff, hardware merchant, Ritzville.
O. C. Ulrich, farmer, Connell.

STATE OF MONTANA

G. M. Moss, publisher, Whitefish.
Sam Stephenson, president First National Bank, Great Falls.
A. L. Jaqueth, consulting engineer, Kalispell.
J. S. James, State engineer of Montana, Helena.
W. F. Jellison, vice president Flathead County Farm Bureau, Columbia Falls.

STATE OF IDAHO

J. V. Hawkins, attorney, Coeur d'Alene.
Compton I. White, president Whitedelft Mining Co., Clarks Fork.
Lloyd Harris, merchant, Lewiston.
F. F. Johnson, chairman of board, Boise City National Bank, Boise.
James F. McCarthy, manager Hecla Mines, Wallace.

STATE OF OREGON

James M. Kyle, farmer, Portland.
Phil Metschan, proprietor Imperial Hotel, Portland.
E. C. Sammons, vice president Iron Fireman Co., Portland.
W. G. Ide, manager Oregon Chamber of Commerce, Portland.
Frederick Steiwer, United States Senator, Pendleton.
Marshall N. Dana, associate editor Oregon Journal, Portland.

EXECUTIVE COMMITTEE

For Washington: Roy R. Gill, executive chairman; Victor H. Elfendahl.
For Oregon: James M. Kyle.
For Idaho: F. F. Johnson; Compton I. White.

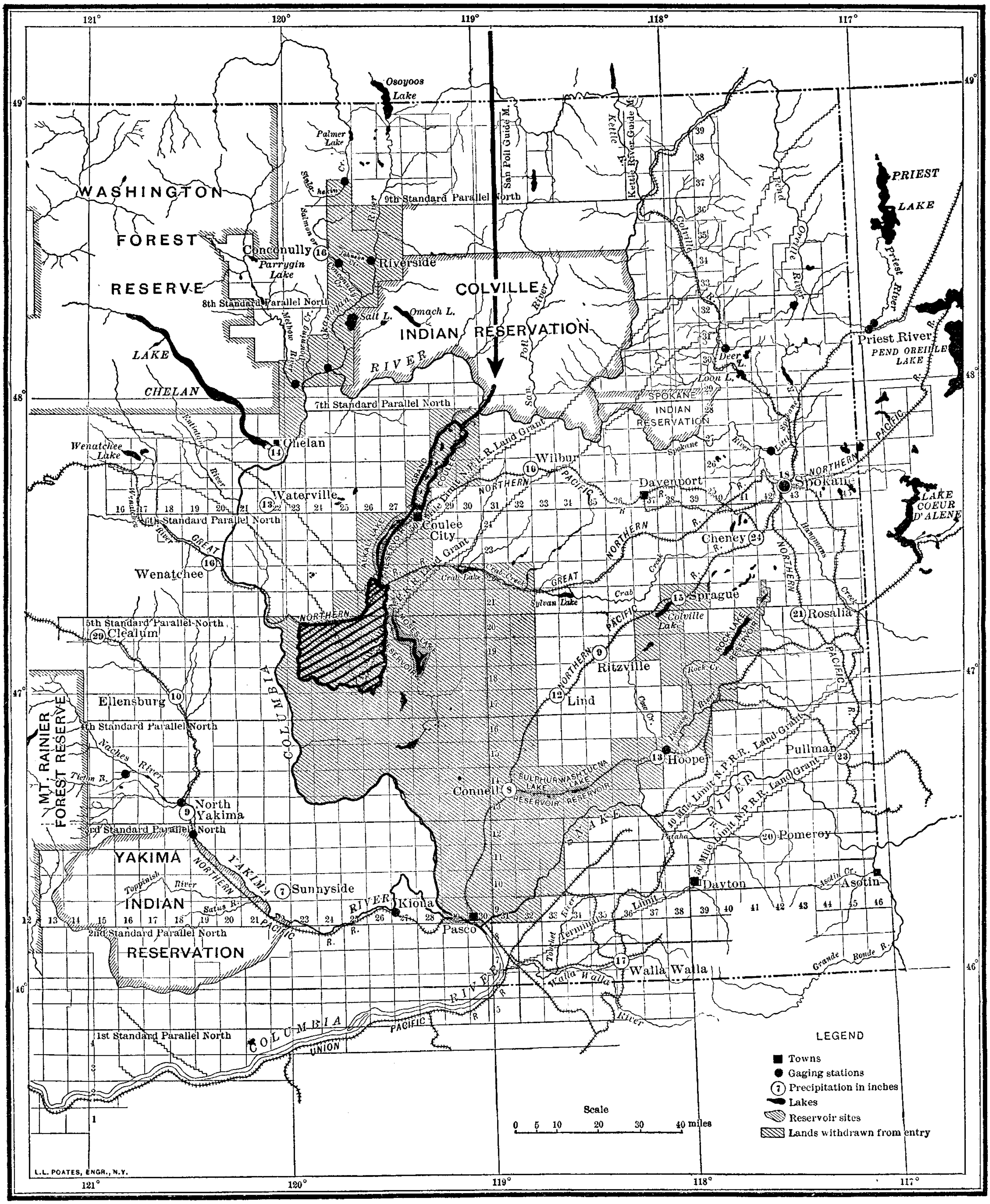
Mr. GILL. I present these names to show the widespread interest in this project and the class of men who have been pushing this development for the past 15 years.

From 1918 until the organization of the league in June, 1922, the promotion of this development was carried on by the Columbia Basin committee of the Spokane Chamber of Commerce, and $38,256.60 was spent by this committee during these five years.

The Bible says, "Without vision the people perish"; and I think it may be safely stated that we, of the Northwest, have had a long range vision on this project, because this project was started in 1903.

What we now call the Columbia Basin project, was first called the Big Bend project, and was investigated by T. A. Noble, engineer of the Bureau of Reclamation, in 1903, who reported his investigations in the second annual report of the Reclamation Service, as follows:

NEW PLAN OF 1931



The above map, made by the Bureau of Reclamation in 1903, shows that the Federal Government at that time was considering the reclamation of the Columbia Basin lands. On this map, in ink, is shown the evolution of the project from a gravity supply from Pend Oreille River in Idaho to the pumping supply from the Columbia River at the Grand Coulee. The part to the west of Moses Lake is the famous Quincy area that will receive the water first. In early days the project was called the "Big Bend project."

125965—32. (Face p. 212.)

This project contemplates the irrigation of a large tract of land in the central part of the State of Washington, lying south and east of the Columbia River and north of the Snake River, in what is known as the Big Bend Country. It is one of the largest projects in the United States. It is believed to be feasible. That portion of the irrigable area which is below elevation 1,700 feet, and which is not profitable for cultivation without irrigation, covers about 3,400,000 acres. It is believed that two-thirds of the land can be irrigated if sufficient water can be brought into the district at an elevation of over 1,700 feet. Columbia River on the north and west and the Snake River on the south, flow through deep and rocky gorges, too low to be feasible, for irrigation purposes except by pumping.

There was made, in 1903, a map, by the Reclamation Bureau, which shows almost identically the map that we have here of the present-day project. I will introduce this map now.

[See map facing page 212.]

Because many smaller irrigation projects absorbed the entire reclamation revolving fund for the following 15 years, this project was not revived until 1918, when Governor Lister, of Washington, and Mayor Hanson, of Seattle, came to Spokane and enlisted the business men in this development. The Spokane community has pulled the laboring oar in this work ever since.

From 1918 until 1931 there have been many engineering studies and examinations made by different agencies and boards, the principal ones being:

Reclamation Bureau in 1913, 1914, 1915.
State of Washington in 1919, 1920, 1921.
General Goethals in 1922.
Reclamation Bureau in 1923, 1924, 1925.
State of Washington in 1926–27.
War Department in 1928, 1929, 1930, 1931.
Reclamation Bureau in 1930–31.

All of these reports are of record and available for the use of this committee.

Without exception, these reports pronounce the project physically feasible.

The amount expended for investigation, examination, and development, by the different agencies, since the beginning in 1903 to the present time, is as follows:

(The list referred to is here printed in full as follows:)

Amount expended for investigation and development of Columbia Basin Irrigation project and related problems, to February 1, 1932

	Dates	Amount
United States Government:		
Palouse project	1903, 1904	$76,409.01
Do	1913, 1914, 1915	10,201.92
State of Washington, Palouse project	1913, 1914, 1915	9,999.70
State of Washington, appropriation of	1919	100,000.00
United States Government:		
Engineer Henny	1922	4,042.95
Appropriation	1923, 1924	96,879.18
Agricultural Department	1924, 1925	2,389.26
Appropriation	1924, 1925	5,687.02
Do	1925 to date	10,648.54
Columbia Basin Irrigation League	Since June, 1922	218,065.14
Spokane expended before formation of league	1919 to 1922	38,256.60
State of Washington:		
Appropriated for 1926		22,500.00
Appropriated for 1927		15,000.00
Expended of $18,000 appropriation	1929–1931	12,832.87
War Department survey (approximate)	1929–1931	450,000.00
United States Government, Columbia Basin survey (approximate)	1931–1932	50,000.00
Total		1,169,912.19

Under the new plan worked out by the United States Government engineers, the project has assumed a different aspect. Previously it was a gigantic irrigation project, that depended on quick settlement of large tracts of land to keep the cost slow to settlers. Now it is a stupendous power revenue producer, with a small first unit of irrigated land, and the slower additional irrigation is brought in the lower the cost to the farmer.

The report of the Bureau of Reclamation, of January 7, 1932, gives the cost per acre as $173.55. Power revenues will take care of one-half of this amount, so the settler would have to pay $87 per acre to the Government, spread out over a period of 40 years. He would also have to pay the cost of operation and maintenance, amounting to $2.59 per acre per year.

The total annual charge, under this plan, is: No charge for the first four years; then, $4.59 per acre for the next four years; and with the beginning of the eighth year, after settlement, to the end of the fortieth year, $5.09 per acre per year.

Now, this is a very outstanding project, and there are many outstanding things about it.

One of the many outstanding features of this great development is the proposal to pass, for the first time, some of the burden of the farmer onto the industries, which will be created in this district, by the farmer putting water on the desert.

Heretofore, there has been no way to put any part of this burden onto industries, but we passed a law in the State of Washington, in March, 1927, which says:

> For the purpose of raising revenue for any of the purposes of this reclamation district, an annual tax shall be levied on all taxable real and personal property within the district.
>
> Said taxes shall be assessed by the county assessor of each county.
>
> Taxes so levied shall become a part of the general tax roll of the county.

The result of this act makes it possible to bring the cost per acre to the farmer from $87 down to about $58 per acre. Our engineers have figured this new law would relieve the farmer of about one-third of the cost of putting water on the land.

Mr. LEAVITT. May I ask you when this tax would begin to be collected?

Mr. GILL. It would be collected by the district which would be organized under the State law of the State of Washington passed in March, 1927, and when they begin to tax the land, or collect the tax, it would be on the ad valorem basis, instead of the per acre basis, so that all of the industries created in this district would assume a part of this burden, and it would further reduce this charge of $5.09 per acre per year, bringing it down about one-third.

This is the first time in the history of reclamation in any State whereby it has been arranged to put a part of the burden of the farmer onto industry, which is created by the fact of the farmer putting water on the land, and I might tell you the origin of that law. In the year 1926, we had a Secretary of Commerce, Mr. Herbert Hoover, out over this project, and he spent four days going over the project, and approved the project. The night he left, he said to the committee: "You have a wonderful project, and I am for it, but I have always thought that irrigation projects did not

assess the burden as they should. For instance, he said, "You take the desert here, and the farmer goes on the project and pays $100 an acre to put water on the land. There are few industries there. In a few years, a few little towns spring up, and the grocery store, the hardware store, the drug store come in, and as time goes on"—he pointed out, there were all kinds of merchants, bankers, doctors, lawyers, and so forth,—and he said, "these fellows have not given 1 cent to aid the farmer in putting this water on the land, and they should stand their share of it."

He said, "In all projects, and especially in such a great project as this, you must safeguard it in every way possible. I think you should have some way to put at least 35 to 40 per cent of the burden onto industry."

We got busy then and passed this law, which puts about one-third of the burden of the farmer onto the industries that may be created.

Mr. SWING. Are any of the incorporated cities to be taxed in this district, for district taxes—Spokane, for instance?

Mr. GILL. Yes, sir; it is proposed to include them in the district.

Mr. LEAVITT. It has been agreed to by Spokane, as I understand.

Mr. GILL. Oh, yes; and all of the cities, of course, out in the area itself there are very few, but in 20 or 25 or 50 years from now, there will be large cities there of a quarter of a million, or half a million people.

Mr. LOOFBOUROW. Is Spokane arbitrarily put within the district, or does the district surround Spokane?

Mr. GILL. Under the gravity plan, as you can see by the map, which we studied first, Spokane was in the district, because there was land there that would come under this plan. We do not know how this district will be created, and we will not know until the project is authorized by Congress, but then we will go out and take in as much as we can under our law, and under our law we can include any number of counties in this district; and naturally it is our desire to make this project as inexpensive as possible to the farmer, and we will put everything into it that we possibly can.

Mr. MARTIN. How far is Spokane from the district?

Mr. GILL. On an air line, about 70 miles, General.

Mr. LOOFBOUROW. How can you tax an outside area?

Mr. GILL. We would have to include Spokane in that area if we taxed it; but, naturally, there will be many cities created in the district in the years to come.

Mr. HILL. Out in Spokane there is some project for pumping out of Spokane River. There is quite a valley there, Spokane Valley.

Mr. GILL. That is a matter to be worked out after the project is approved by the United States Government.

The splendid climate, abundance of water, long-growing season, unusual fertility of soil, and the very low cost of water makes this the most attractive project ever placed before the American people.

Mr. GILL. Another point not covered by previous witnesses is the fact that this project does not contemplate bringing in new land, in the usual sense, because nearly all of this land was homesteaded in the nineties. And for many years they raised good crops of wheat, until the dry cycle came upon us 8 or 10 years ago.

Thus, we would be converting this area from wheat raising to alfalfa, potatoes, onions, melons, fruit, and other products of irrigation, thereby reducing the wheat production to that extent.

I will read from the Government report by the Reclamation Bureau:

History of development.—Nearly 60 years ago every alternate section of the Columbia Basin lands was granted to the Northern Pacific Railway by act of Congress to assist in financing that enterprise. These lands were advertised and sold about 30 years ago to prospective settlers in tracts usually ranging from 160 acres to several sections for wheat raising.

The remainder of the area, except where acquired by the State for school purposes, was Government land subject to homesteading and was taken up by settlers in 160-acre units about the beginning of the present century. Settlement was pushed westward, during a series of wet years, covering most of the good lands of the proposed project. Improvements were made and in many cases good buildings were erected. It was soon recognized, however, that the desert had been penetrated too far. A few years of normal rainfall proved the futility of attempting to grow crops over any but the higher and better lands where rainfall, although light, was sufficient to grow a wheat crop every other year under summer-fallow methods. Meanwhile, however, loans had been made by banks, nonresident capitalists, and loan companies to finance the settlers. When the crops failed the farmer moved on and the creditor took the land, and in this way large areas once in cultivation have gone back to wild cheat grass and sage brush. The ownership records show that about 90 per cent of the area is owned by people living in widely scattered parts of the United States. Individual ownerships vary from a few acres to several sections. One banking concern owns 27,880 acres, and the average holdings for 79 owners is 2,240 acres. A check of the county holdings shows that Adams County owns 13,340 acres; Grant County, 35,000 acres; and Franklin County 21,900 acres. These lands have been acquired by tax title.

About one-third of the project area is still being cultivated to wheat in large tracts largely under a system of tenant farming. Individual farms usually average from 320 acres to two or three sections each. In one case three brothers are reported to be farming 32,500 acres. The yields of wheat average around 5 to 12 bushels per acre on the land in crop. The land is seeded every other year and cultivated clean during the off year. When precipitation is plentiful, occasionally fields yield up to 30 or 35 bushels per acre.

In that connection, I would just like to show you a very few of the deserted farms, to any of you gentlemen who have not been out in that section. Here are a few of them, and many other thousands can be seen in the farm pictures taken by the War Department.

(Thereupon, the pictures were passed among the members of the committee.)

Mr. SWING. What part of the land shown on the map is public land, and what part is individually owned?

Mr. GILL. Very little public land, Mr. Swing.

Mr. MARTIN. The State must own a lot of land, and the counties.

Mr. GILL. Yes.

Mr. SWING. What is the elevation above sea level?

Mr. GILL. It is 1,700 feet above sea level in this section, in the northeast part, down to the Columbia River about 400 feet.

Mr. MARTIN. Do you know how much of this land is owned by the State and county now?

Mr. GILL. That is a part of the record now, but I could not tell you offhand, General, but there is very little public land left; it is nearly all now given back to the counties for taxes. People have gotten up and deserted farms and their homesteads, and they have gone back to the counties, mostly.

Mr. BUTLER. A lot of it is held by mortgage companies?

Mr. GILL. Yes.

Mr. O'SULLIVAN. There are still lots of settlers on that land.

Mr. GILL. Yes; I know there are. Some of you who have gone over the project have seen them, and there are many settlers still hanging on. Some of them have little wells from which they pump water.

Mr. GILL. The three most important elements required for a successful irrigation project are: First, an abundant water supply; second, fertile soil; third, a good climate. The Columbia Basin project has all of these.

I think climate is probably the most important, and I want to say a few words about the climate in this country.

In the report by the Reclamation Bureau:

> The climate of the Columbia Basin varies considerably in different parts of the project, but possesses the general characteristics of that prevalent in the intermountain country. The precipitation is light and occurs mostly between October 1 and the 1st of June following. This results in a large percentage of clear sky with rather intense sunshine and with hot days and cool nights during the growing season.
>
> The very limited summer rainfall facilitates farming operations under irrigation, both from the standpoint of fullest use of labor and also from the standpoint of harvesting products of high quality with a minimum of handling and of damage from bad weather.
>
> The annual mean temperature is very nearly the same at Hatton, Lind, and Wheeler as at Yakima and Sunnyside, Wash., on the Yakima project, and at Caldwell, Idaho, on the Boise project, with a slight tendency for the winters to be colder and the summers warmer at Columbia Basin points. Both the annual mean and the mean for the growing season are considerably higher at Kennewick and Wahluke, representing the southern portion of the Columbia Basin, than for the northern stations or the outside points mentioned above.
>
> The average date of last killing frost in spring at Wheeler, Lind, and Hatton, is comparable to Sunnyside, while Yakima and Kennewick are nearly the same but are considerably earlier than the others. Caldwell is appreciably later than any of the above localities. The average date of the first fall frost is practically the same for Lind, Sunnyside, and Caldwell, while it is nearly a week later at Wheeler, Hatton, Kennewick, and Yakima.

Mr. GILL. Another thing that I want to point out: There is no record of any destructive storms in any part of this project. The Spokane office of the United States Weather Bureau reports that there never have been recorded disastrous storms, cyclones, tornadoes, floods, or earthquakes.

I want to show you a map of this area. This is a Red Cross map, showing the places in the United States where the Red Cross has had to step in and aid in cases of this kind. Notice the northwest section. It shows the Inland Empire, and that [indicating] is the circle embraced by this project. This area has been absolutely free from climatic disasters of every kind. Never has the American Red Cross been called upon to extend relief to the inhabitants of this section caused by destruction either to life or to property.

I will read a quotation from the American Magazine for June, 1927, an article by Dr. J. Russell Smith, professor of economic geography at Columbia University. He is an international authority on industry and on world-food resources. His books include The Story of Iron and Steel, The Organization of Ocean Commerce,

Human Geography, and others. He is making a report on the climatic conditions of the United States, and he says:

Then there is another region for which we can foresee a wonderful future—the Northwest!

The particular section to which I refer consists roughly of 50 by 400 miles on the Pacific coast of Oregon and Washington in the Puget Sound-Williamette River Valley region, where are located the cities of Seattle, Portland, Tacoma, Everett, Bellingham, and a few others. * * * The population of this area is now about a million. It will almost certainly increase to 5 or 6, perhaps 10 millions. A thriving land of cities in the midst of dairy farms and a rich garden agriculture, such as we find in the best parts of England and Belgium.

To Dr. Ellsworth Huntington we are indebted for epoch-making observations in the study of the part that climate plays in the making of civilization. If the theory presented in his great work, Civilization and Climate, were at variance with everyday experience we might look at it askance; but the experience of common men, and the history of many countries, seem to confirm his most important conclusions.

Doctor Huntington's main conclusion, in brief, is this: A man feels more inclined to be active, and will do more physical work, at a temperature of about 60 degrees (55 to 70 degrees) than when it is colder or warmer. He also states that man does his best brain work when the outdoor temperature is about 40 degrees. Study the temperature charts of Seattle and Portland, and you will be struck by the fact that in winter the temperature there is right for the maximum of mental activity; in summer it is right for the maximum of physical activity.

Another of Doctor Huntington's conclusions is that man needs a moist climate to perform at his best—and the climate here is moist. Also, it is changeable. And changes in temperature wake men up, energize them, and make them want to do things; * * *

You will recall the period during the Great War when the whole Nation was striving to build ships with all possible speed.

At Philadelphia, the sun, shining upon the men and also upon the metal ships on which they worked, produced so much heat that at times the men had to rest. There were many accounts of heat stroke and sunstroke in the eastern yards. But heat didn't interrupt work in the shipyards of the Pacific Northwest. The Puget Sound yards won more pennants than those of any other section in general shipbuilding, in riveting, in welding, in framing wooden ships, in bolting. This we must regard as of vast importance; for to build a community, a city, a civilization, requires brains and brawn, imagination and pushing power, and depends not only upon numbers of people but upon people with brains and energy, and a disposition to exercise them.

Basing my assertion on past history and economic and industrial conditions of to-day, it is in the Northwest where I expect American civilization, in many ways, to reach its maximum. Yes; I expect that it will outstrip New York, overcoming the advantage which the metropolis has had of an early start! In this Northwest of which I speak, I anticipate that, man for man, Americans will eventually realize their greatest achievement; almost certainly their greatest physical achievement, perhaps also their highest mental achievement—in science, literature, and the arts!

To be sure, there are numerous reasons apart from the climate that lead one to predict an unrivaled future for this part of the country. It is a splendid land for agriculture. It is accessible for trade. The Panama Canal offers transportation facilities. As to mechanical energy, the Cascades and the Coast Range, along with the Rockies, give the cities between Portland and Vancouver access to many millions of horsepower of hydroelectric energy. Nowhere in Europe nor in the Eastern United States is there any location for water-power resource that rivals it.

Mr. GILL. That points out the climatic conditions in that country.

And I want to say further, gentlemen, that it is a white man's country; and I am not now speaking in any way disparaging to other sections of the United States. But if you go up into our country and look at the people out in the fields doing the manual labor, planting and cultivating, you will find that they are white men. During this past year I have been all over every irrigation project in

the West. I have been over Mr. Swing's wonderful project in the Imperial Valley, and it is wonderful. Nothing can compete with it. But when I come back to the Northwest, and go through the little towns, Yakima and Wenatchee, and I see the farmers in overalls and shirt sleeves coming out to work, they are white men; because it is a white man's country. The summers are not too hot for white men to do their work.

And following right along that line, I want to file the Government statistics on illiteracy, issued in 1930, showing the rank of States. It places Iowa first; Washington and Oregon, second.

All that is because, as I tell you, this is a white man's country. It is a land where white men like to get out and do the manual work.

Mr. SMITH. You are offering this testimony as an argument——

Mr. GILL (interposing). To show that this is an outstanding project, Mr. Smith.

Mr. SMITH. Yes; but to show the possibilities of building up the northwestern country and making it possible to provide a market for the water power that will be developed as the years go on.

Mr. GILL. That is right.

Mr. SWING. I thought he was offering it to get the southern California citizens to move up there.

Mr. GILL. We will welcome you.

Mr. LOOFBOUROW. I thought he was stealing California's thunder all the time.

Mr. GILL. Now, gentlemen, we out on the Pacific coast feel this way. We like to go to California in the wintertime. There is no place that equals it. But in the summer time we like to get up into the Green playgrounds of the Northwest.

Mr. CROSS. There are a whole lot of members of this committee from way down South.

Mr. GILL. We invite you out there; and if we get you out there, we think you will stay.

This Government record of B. E. Hayden says further:

The Columbia Basin project within its boundaries contains recreational advantages provided by its citizens, such as churches, movie houses, and swimming pools; but within a day's drive in any direction the mountains may be reached, where hunting and fishing, together with all the pleasures of camp life, may be enjoyed.

In one day, from the heart of this project into the Rockies, the Bitter Roots, the Selkirks, and the Cascades, where unexcelled big game hunting and trout and salmon fishing may be had. [Continues reading:]

For those who prefer to spend their vacation in the city or at the seaside, excellent highways are provided to Seattle, Portland, and the coast. One day's time enables one to reach the most distant of these points.

Mr. GILL. I want to tell you about the size of the Columbia River. It drains 259,000 square miles of territory. This watershed extends from Glacier and Yellowstone Parks to the Pacific and from the Fraser River on the north to the Klamath on the south. At The Dalles, away down below, on the river, the Columbia River has a run-off equal to that of the St. Lawrence or the Danube. At Pasco, before it receives the waters of the Snake River, it is larger than the Fraser, the Missouri or the Nile. At Trail,

way up in British Columbia, it carries more water than the Yukon, and the Clark Fork alone discharges more water into the Columbia—probably 800 miles from the mouth—than the Colorado River carries at the site of the great Hoover Dam.

A member of this committee asked what could be raised on this project. The soil and climate are so similar to Yakima—the principal difference being that the Columbia Basin has a two weeks longer growing season—that a report from the superintendent of the Yakima project to Doctor Mead, giving the carload shipments from Yakima for the year 1928, would, I think, be a good answer. This is the list of carload shipments from Yakima for 1928:

	Carloads		Carloads
Apples	9,097	Prunes	331
Pears	3,848	Strawberries	16
Mixed fruits	1,945	Asparagus	76
Apricots	144	Melons	420
Cherries	436	Onions	420
Grapes	237	Mixed vegetables	434
Peaches	1,637	Potatoes	3,072

A grand total of 22,132 cars out of the Yakima Valley in the year 1928; and not one carload of wheat or corn.

Mr. SWING. Any cotton?

Mr. GILL. No cotton, Mr. Swing.

Mr. HILL. The nights are too cold for cotton.

Mr. GILL. There is a feeling that irrigation projects and the products of irrigation projects compete with the Middle West. I am not going to tire you with statistics, but I will put them in the record. I will just give you a record of the Bureau of Reclamation for the production of 1929 and 1930, giving the entire production of competitive crops on irrigation projects as against total crops.

I will mention wheat.

Wheat, on all of the irrigation projects, in 1929 was 0.48 per cent—a little over four-tenths of 1 per cent—of the total crop of the United States.

Corn was 0.5 per cent in 1929.

Cotton, 1.2 per cent in 1929.

And the rest of the items will be put in the record.

(The statement by Judge P. W. Dent, Assistant Commissioner of Reclamation, is as follows:)

SOME ECONOMIC ASPECTS OF WESTERN FEDERAL IRRIGATION

(By Porter W. Dent, Assistant Commissioner Bureau of Reclamation, Department of the Interior)

OVERPRODUCTION NOT INCREASED BY FEDERAL RECLAMATION

The assertion is often made that the crops grown upon Federal irrigation projects add to the surplus of agricultural products and thus aggravate the problem of overproduction. It is submitted that crops grown upon Federal irrigation projects have no appreciable effect on the regulation of prices generally for the following reasons:

First. The total cropped area on Federal reclamation projects constitutes only about four-tenths of 1 per cent of the total area in cultivation in the United States. The value of crops produced on such projects is only about 1 per cent of the total value of agricultural products in the United States.

Second. The crops so produced are of particular or specialized kinds, of which for the most part no surplus exists, or they are seasonal in character, and are not competitive with those crops grown elsewhere. A large portion of the areas of these projects is given over to the production of alfalfa and other forage crops consumed locally. These crops comprise 31 per cent of the cropped area of the Federal projects, and constitute 18 per cent of the total crop value, but they amount to only somewhat less than 4 per cent of the total national production. Alfalfa, because of its bulk and of the freight rates applicable, can not be shipped long distances. It is accordingly consumed largely on the farms where raised or in the locality, in the feeding of livestock and in other ways. Alfalfa and other forage crops are necessary to support the ranges tributary to the projects. The range country and the projects are complementary each to the other and both are indispensable to the development and welfare of the West.

Five and one-tenth per cent of the project areas are planted to sugar beets. The Western States produce the greater part of the total tonnage of this crop. Large quantities of sugar are imported annually. Hence it can not be said either that there is an overproduction of sugar beets in the United States or that this product of the Federal projects operates to the prejudice of the humid sections.

Wheat is the crop of which an overproduction is perhaps more accentuated than any other. Of this commodity Federal projects produced in 1919 only 3,910,000 bushels, just under one-half of 1 per cent of the total. The United States is a wheat-exporting country, and normally it must be assumed that the price of this product is taxed by the word supply and demand. Certainly no one can seriously contend that the quantity of wheat grown on Government projects could have any material effect on the agricultural situation. It is likely that there will always be some wheat grown on the projects, largely to supply local markets. But the constant trend is toward lesser production. In 1930 the production dropped to 3,614,000 bushels. Of this amount 75 per cent is produced on projects located west of the Rocky Mountains. The Montana projects produce almost entirely hard spring wheat, for which there is a steady demand and which sells at a premium based on the protein content.

The production of barley and oats shows a slight increase on the projects, partly in substitution for wheat. These crops, which constitute less than 1 per cent of the total production, are fed largely to livestock on the farm and do not come into competition with production in the humid sections. The basic industry of Federal projects is the production of forage crops to be fed to livestock.

Cotton is produced only on those projects situate in the Southwest. These projects are the Carlsbad in New Mexico, the Rio Grande in Texas and New Mexico, and the Yuma and Salt River projects in Arizona. It is only in recent years that this staple has been produced on the Rio Grande. It is quite likely that this project will revert to the raising of alfalfa and diversified crops after the manner of the former practice. The cotton raised on these projects is of the long and medium staple variety. Accordingly they do not come into sharp competition with the short-staple production, of which the surplus or overproduction is the most acute.

Vegetables produced on the southwestern projects, such as winter lettuce, cabbage, cantaloupes, strawberries, and other small fruits, reach the early markets and furnish a very desirable variety of food at a price within the reach of all. They are in general not competitive in character, but they do fulfill a real demand which could not be supplied from other sources at prices the average consumer can afford to pay.

The foregoing is a general statement merely concerning the chief crops produced. For the information of those who may desire to have a more complete statement the following tabulation is appended showing the agricultural production on Federal reclamation projects as compared with the entire production for the United States for 1929 and 1930:

	Year	Entire United States	Federal reclamation projects	Per cent reclamation projects
Value of crops	1929	8,088,494,000	88,459,390	1.10
	1930	5,818,849,000	64,971,470	1.10
Acres in crop	1929	357,827,000	1,512,250	.42
	1930	359,927,000	1,550,987	.43
Bushels of corn	1929	2,535,386,000	1,254,496	.05
	1930	2,060,185,000	1,635,595	.08
Bushels of wheat	1929	812,573,000	3,910,036	.48
	1930	858,160,000	3,613,865	.44
Bushels of barley	1929	280,242,000	2,713,374	.97
	1930	304,601,000	2,888,129	.95
Bushels of oats	1929	1,118,414,000	1,709,249	.15
	1930	1,277,764,000	1,654,161	.13
Bushels of rye	1929	34,950,000	66,855	.19
	1930	45,379,000	92,440	.20
Bushels of alfalfa seed	1929	982,400	136,328	13.90
	1930	1,145,400	499,029	43.50
Bushels of flax	1929	15,910,000	25,987	.16
	1930	21,240,000	41,783	.20
Tons of hay	1929	87,308,000	63,631	.07
	1930	74,214,000	69,024	.10
Tons of alfalfa	1929	23,854,000	1,303,946	5.50
	1930	22,871,000	1,312,415	5.50
Bushels of sweetclover seed	1929	1,167,300	70,502	6.00
	1930	848,300	59,107	7.00
Bushels of beans	1929	20,514,000	390,067	1.90
	1930	23,063,000	778,071	3.40
Bushels of potatoes	1929	329,134,000	8,302,196	2.50
	1930	333,210,000	12,556,237	3.80
Bushels of apples	1929	135,622,000	4,971,050	3.70
	1930	155,982,000	6,658,319	4.10
Bushels of pears	1929	21,172,000	1,028,000	4.80
	1930	25,540,000	1,423,211	5.60
Bushels of peaches	1929	45,026,000	465,720	1.00
	1930	53,864,000	344,354	.70
Tons of sugar beets	1929	7,366,000	956,719	13.00
	1930	9,262,000	1,043,847	11.30
Bales of cotton	1929	14,828,000	173,732	1.20
	1930	13,932,000	170,056	1.20

Mr. GILL. I will not read, but I want to file for the record resolutions by the Washington State Grange and other granges favoring this project.

Mr. SWING. What is the date of that?

Mr. GILL. June 1 to 5, 1931.

Mr. SWING. I am glad to see that they have gotten daylight.

Mr. GILL. Yes.

I want to quote just one more thing about this soil report of Mr. Hayden to which I referred. They sent out questionnaires to all owners of land within the entire project asking many questions. One was, "Are you in favor of irrigation of the Columbia Basin project?" Of the replies received, 91 per cent were "yes"; 4 per cent were "no"; unanswered, 5 per cent. That shows that the farmers of that country are pressing for this project.

Gentlemen, that concludes my testimony, and I thank you very much for your attention.

The CHAIRMAN. We appreciate your attendance and your statement.

(The matter submitted by Mr. McGill is here printed in full as follows:)

ILLITERACY STATISTICS FOR THE UNITED STATES, 1930

Rank of States, 1930—percentage of illiteracy

1. Iowa	0.8	26. Pennsylvania	3.1
2. Oregon	1.0	27. Massachusetts	3.5
3. Washington	1.0	28. New York	3.7
4. Idaho	1.1	29. Maryland	3.8
5. Kansas	1.2	30. New Jersey	3.8
6. Nebraska	1.2	31. Delaware	4.0
7. South Dakota	1.2	32. Nevada	4.4
8. Utah	1.2	33. Connecticut	4.5
9. Minnesota	1.3	34. West Virginia	4.8
10. North Dakota	1.5	35. Rhode Island	4.9
11. District of Columbia	1.6	36. Kentucky	6.6
12. Wyoming	1.6	37. Arkansas	6.8
13. Indiana	1.7	38. Texas	6.8
14. Montana	1.7	39. Florida	7.1
15. Wisconsin	1.9	40. Tennessee	7.2
16. Michigan	2.0	41. Virginia	8.7
17. Vermont	2.2	42. Georgia	9.4
18. Missouri	2.3	43. North Carolina	10.0
19. Ohio	2.3	44. Arizona	10.1
20. Illinois	2.4	45. Alabama	12.6
21. California	2.6	46. Mississippi	13.1
22. Maine	2.7	47. New Mexico	13.3
23. New Hampshire	2.7	48. Louisiana	13.5
24. Colorado	2.8	49. South Carolina	14.9
25. Oklahoma	2.8		

Per cent of total population, 4.3.

The CHAIRMAN. Does this conclude the hearing, gentlemen?

Mr. HILL. This concludes our testimony. If I may make a brief statement, I should like to do so.

The CHAIRMAN. We will be glad to hear you.

Mr. HILL. I would like to call to the attention of the committee again that a redraft of this bill was submitted by the Secretary of the Interior in his report to the committee on the bill. It follows generally, of course, the line of the original bill, but there were a number of changes, and it was more convenient simply to make a redraft than to write in the suggested amendments in the original bill; and I ask that the committee, when it goes into executive session to consider the bill, consider the redraft with the view of offering it as a committee amendment to the original bill, striking out all after the enacting clause of the original bill and substituting this for it.

I just want to call that to your attention once more.

The CHAIRMAN. In other words, you have no objection to that suggestion?

Mr. HILL. We are for it.

Mr. SWING. You request the committee to report the bill as suggested by the department?

Mr. HILL. Yes.

The CHAIRMAN. Now, gentlemen, I will call you again to consider this matter.

If there is no objection on the part of any member of the committee, the chairman will order the printing of this hearing, to be distributed among the members as early as possible. If there is any objection to that course on the part of any member of the committee I would like to hear you now.

Mr. SMITH. Have you an estimate of the cost of printing?

The CHAIRMAN. I think the clerk of the committee has it.

The CLERK. On the report of the Reclamation Bureau, it is $778.

Mr. SMITH. It will be necessary to get the consent of the Committee on Printing, I presume.

The CLERK. We have it.

Mr. HILL. Mr. Smith, there has been a little misunderstanding on the part of the printer, as I get it, as to whether this is to be a part of the hearings. I presented it as a part of the hearings. Then it would go in as a part of the committee proceedings, and that might put a little different light on the situation from the standpoint of the printer. The printer seems to have the idea that we wanted it printed as a separate document, not connected with or a part of the hearings. Now, we want it a part of the hearings.

The CHAIRMAN. We will have no trouble on that, gentlemen, if there is no objection on the part of the committee.

(There was no objection.)

Mr. HILL. I want to thank the committee, on behalf of myself and the entire Washington State congressional delegation, for its patience and courtesy. We believe that we have made out a case, and we hope that you may agree with us.

The CHAIRMAN. Thank you.

EXTENSION OF THE COLUMBIA RIVER APPORTIONMENT ACT

Mr. LEAVITT. Mr. Chairman, I have a matter that has to do with this Columbia Basin proposition. You will recall that this committee reported out the bill (H. R. 5649) to extend the life of "An act to permit a compact or agreement between the States of Washington, Idaho, Oregon, and Montana, respecting the disposition and apportionment of the waters of the Columbia River and its tributaries, and for other purposes," and that it was considered one of the things necessary to be done in connection with this entire proposal. I ask that a copy of the bill as reported by this committee may be inserted in the record at this point.

The CHAIRMAN. Without objection, it is so ordered.

(The bill referred to is here printed in full as follows:)

[H. R. 5649, Seventy-second Congress, first session]

A BILL To extend the life of "An act to permit a compact or agreement between the States of Washington, Idaho, Oregon, and Montana respecting the disposition and apportionment of the waters of the Columbia River and its tributaries, and for other purposes"

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the time within which the States of Washington, Idaho, Oregon, and Montana may enter into a compact or agreement respecting the disposition and apportionment of the waters of the Columbia River and its tributaries as authorized by the act approved March 4,

1925 (43 Stat. L. 1268), and the amendatory act of April 13, 1926 (44 Stat. L. 247), and March 3, 1927 (44 Stat. L. 1403), is hereby extended to January 1, 1935.

Mr. LEAVITT. That bill passed the House on January 18 last and the Senate committee has reported it with an amendment, adding a proviso, as follows:

Provided, That the State of Wyoming shall be made a party to such compact or agreement.

So that the bill would read:

Be it enacted * * *, That the time within which the States of Washington, Idaho, Oregon, and Montana may enter into a compact or agreement respecting the disposition and apportionment of the waters of the Columbia River and its tributaries * * * is hereby extended to January 1, 1935: *Provided*, That the State of Wyoming shall be made a party to such compact or agreement.

I ask that a copy of the Senate report on that bill may be inserted at this point.

The CHAIRMAN. If there be no objection, that will be done.

(The report referred to is here printed in full, as follows:)

[Senate Report No. 733, Seventy-second Congress, first session]

The Committee on Irrigation and Reclamation, to which was referred the bill (H. R. 5649) to extend the life of an act to permit a compact or agreement between the States of Washington, Idaho, Oregon, and Montana, respecting the disposition and apportionment of the waters of the Columbia River and its tributaries, and for other purposes, report thereon with recommendation that it do pass with the following amendment:

At end of line 10, strike out period, insert colon, and add the following:

"*Provided*, That the State of Wyoming shall be made a party to such compact or agreement."

This bill has the approval of the Secretary of the Interior as will appear from the following letters:

DEPARTMENT OF THE INTERIOR,
Washington, December 29, 1931.

Hon. ROBERT S. HALL,
Chairman Committee on Irrigation and Reclamation,
House of Representatives.

DEAR MR. CHAIRMAN: In response to your request of December 21, for a report on H. R. 5649, which would extend the life of "An act to permit a compact or agreement between the States of Washington, Idaho, Oregon, and Montana respecting the disposition and apportionment of the waters of the Columbia River and its tributaries, and for other purposes," there is transmitted herewith a memorandum on the subject that has been submitted by the Commissioner of Reclamation.

After a review of the proposed measure, I agree with the commissioner.

Very truly yours,

RAY LYMAN WILBUR, *Secretary.*

DEPARTMENT OF THE INTERIOR,
BUREAU OF RECLAMATION,
Washington, December 24, 1931.

Memorandum for the Secretary.

The attached letter of December 21 from Hon. Robert S. Hall, chairman Committee on Irrigation and Reclamation, House of Representatives, requests report on H. R. 5649, "A bill to extend the life of 'An act to permit a compact or agreement between the States of Washington, Idaho, Oregon, and Montana respecting the disposition and apportionment of the waters of the Columbia River and its tributaries, and for other purposes.'"

The bill provides for the extension to January 1, 1935, of the time within which to formulate and execute compacts among the States mentioned in the title. The bill refers to the act approved March 4, 1925. This act was amended

by the act of April 13, 1926 (44 Stat. 247). The latter act extended the time from January 1, 1927, to December 1, 1927, and authorized an appropriation of $25,000 for completing certain investigations concerning the watershed of the Columbia River. The act of March 4, 1925, was further amended by an act approved March 3, 1927 (44 Stat. 1403), which extended the provisions of former acts to December 31, 1930. No reference is made in the present bill to these acts. Perhaps this is not necessary, but it will be noted that in the amendment of March 3, 1927, reference was made both to the original act of March 4, 1925, and to the amendment of April 13, 1926.

The formulation and execution of a suitable compact among the States mentioned seems desirable, and the further extension of time for this purpose is necessary. I accordingly recommend favorable consideration of the bill.

ELWOOD MEAD, *Commisisoner.*

Mr. LEAVITT. What I would like to have is the approval of the committee to the Senate amendment. I have no personal objection to it. It seems that one of the tributaries of the Columbia River rises in Wyoming, and the Wyoming people simply want to be sure that what rights they may have are taken into consideration.

Mr. BUTLER. The amendment is rendered necessary because Mr. Smith's bill provided for an agreement between Idaho and Wyoming, did it not?

Mr. LEAVITT. I have not studied that bill, but possibly so.

Mr. SWING. I think we had better call Mr. Smith in.

Mr. LEAVITT. As far as I am concerned, I can not see any objection to having Wyoming, in which one of the tributaries arises, included in the agreement.

Mr. SWING. I would like to have Mr. Smith notified of it.

Mr. BUTLER. The bill has been reported out?

Mr. LEAVITT. Yes; it has. This bill has passed the House and amended in the Senate committee. What I would like to have is that this committee approve the Senate amendment and authorize the chairman to so state to the House, so that the amendment may be concurred in and gotten out of the way when the opportunity comes.

Mr. BUTLER. There is no conflict in the bills at all. That is a local situation between Idaho and Wyoming. The amendment they make could not affect any of the nonparticipating States in that agreement.

Mr. LEAVITT. The Smith bill is the same as another one we reported, except that it had to do with Montana and Wyoming. That bill has also passed the House and there is a favorable report in the Senate. This action which I now request would advance the situation; because Wyoming might, if it has some rights, enter in and make objection, and retard the whole movement unless she is included. It will be better to have them take part in the compact.

Mr. BUTLER. The important thing is to get everything through.

Mr. LEAVITT. Yes; we can not do anything with the Columbia Basin project; without the opposition of some of the States, until——

Mr. MARTIN. Have conferees been appointed on this?

Mr. LEAVITT. No; they have not. The motion I make is that the committee authorize the chairman of the committee to agree to the Senate amendment at the proper time, so that the bill will be passed.

Mr. BUTLER. I second the motion.

Mr. SWING. Still, I think we ought to give Mr. Smith a chance to be heard on it. I do not know anything about it.

Mr. LEAVITT. This bill was reported out in the Senate by Mr. Smith's Senator, Mr. Thomas, so the interests of Idaho have been taken care of unquestionably.

Mr. SWING. Once in a while a Congressman and a Senator do not agree on everything. I do not see any objection to it, but it is a courtesy that I think we owe Mr. Smith.

May we not lay it on the table until 12 o'clock, when we adjourn?

Mr. BUTLER. How will this do, to approve the request, subject to any opposition Mr. Smith might have, and have the understanding that, if he makes any opposition, we will hold it up; and if he makes no opposition, let it go along.

The CHAIRMAN. Gentlemen, I will suggest this: I do not know that we can conclude the hearing we are on to-day, but that will wind up the work of the committee. Let me suggest that we adjourn to-day to meet to-morrow morning at 10.30 o'clock, and I will notify Mr. Smith. I suggest that we let it remain on the table until to-morrow.

Mr. SWING. I have no objection to the proposal made by Judge Butler. If Mr. Smith does not object to it, then it will be reported.

Mr. LEAVITT. It might be that the Senators and some of the Representatives of these States will be standing in the way of the Columbia Basin project until this compact has been authorized, so they will know their rights in the water are taken care of. We do not want that situation to arise. Everybody agrees, the Representatives of all of the States, we think, when this matter was up. I overlooked, in introducing the bill to extend the time, the fact that one of the tributaries did arise in Wyoming. It had not been so stated in the act as it had originally passed. My bill was to extend an act which had been previously passed and extended twice, simply to give it a further lease on life, because the compact had not meanwhile been entered into as authorized.

Mr. LOOFBOUROW. Why not let the amendment be passed, subject to the proposal made by Judge Butler?

The CHAIRMAN. Very well, gentlemen, I think the motion has been made and seconded. You accept the proposal made by Judge Butler, do you not?

Mr. LEAVITT. That is all right. I know Mr. Smith has no objection.

The CHAIRMAN. Very well; we will let the matter remain that way for the time being.

(Whereupon the committee proceeded to the consideration of other matters.)

(During the consideration of other matters pending before the committee Mr. Smith appeared and participated in the proceedings

The CHAIRMAN. Before we adjourn, Mr. Smith, Mr. Leavitt has a matter to present which we had under consideration prior to your arrival.

Mr. LEAVITT. Mr. Smith, you remember that we reported out of this committee a bill (H. R. 5649) to extend the life of "An act to permit a compact or agreement between the States of Washington, Idaho, Oregon, and Montana respecting the disposition and apportionment of the waters of the Columbia River and its tributaries, and for other purposes." That bill passed the House, then went over to the Senate,

and has been reported to the Senate by your Senator Thomas, with an amendment adding these words:

Provided, That the State of Wyoming shall be made a party to such compact or agreement.

I have made a motion to the effect that when this Senate amendment comes over to the House it shall be agreed to, and that the chairman be authorized to request the House to agree to it. Mr. Swing has raised the question as to whether this amendment will interfere with the bill that you introduced providing for a compact between Wyoming and Idaho.

Mr. SMITH. I am apprehensive that it would be difficult to get a large commission together, and on general principles I am not in favor of the amendment; but as Senator Thomas has presented it to the Senate, I will not interpose any objection to your incorporating it. But on our bill that passed permitting Idaho and Wyoming to enter into a compact, we expected to get early action. This bill is made necessary because the States have never acted on the old law.

Mr. SWING. Your bill could still go through, Mr. Smith.

Mr. LEAVITT. This would not interfere with the general question between the two States.

Mr. SMITH. No. I have no objection.

The CHAIRMAN. Mr. Smith says he has no objection, and that order will be entered.

(Thereupon the committee adjourned to meet at the call of the chairman.)

THE COLUMBIA BASIN PROJECT

MONDAY, JUNE 13, 1932

HOUSE OF REPRESENTATIVES,
COMMITTEE ON IRRIGATION AND RECLAMATION,
Washington, D. C.

The committee met pursuant to call of the chairman, at 10 o'clock a. m., in the committee room, No. 333 House Office Building, Hon. Robert S. Hall (chairman) presiding.

Present: Representatives Hall (chairman), Chavez, Miller, Overton, Martin, Smith, Leavitt, Swing, Butler, and Loofbourow.

The CHAIRMAN. The committee will come to order. We have with us Mr. McFadden of Pennsylvania.

I would like to state, Mr. McFadden, that the committee had concluded the hearings on this matter, with the reservation, however, that the proponents might be permitted to say something after you had completed your statement.

You may proceed, Mr. McFadden.

STATEMENT OF HON. LOUIS T. McFADDEN, A REPRESENTATIVE FROM THE STATE OF PENNSYLVANIA

Mr. McFADDEN. Mr. Chairman, I am very much opposed to the further development on the part of the Government, on the participation by the Government in irrigation projects, principally for the reason that one of the main troubles in our economic situation to-day is overproduction on the farms of the country. Besides the general financial condition of the country and the particular predicament that the Government finds itself in at this time, should be taken into consideration. I am firmly of the opinion that if this depression keeps on the Congress is going to be placed in the position of having to cut down all of these cooperative movements where the Government is matching appropriations with the States, known as State-aid funds, and further aid to these big development projects, including water power and irrigation. In other words, expenditures have got to be cut to the bone even if in the form of loans.

It seems to me a ridiculous proposition that in a situation like this, where production is beyond our ability to consume, we should with Government money continue to encourage and increase this production. I do not believe that it is fair to those agricultural interests that are struggling along without Government aid and assistance to encourage the continuation of developments of this kind.

In January, 1929, I made some observations on this question of irrigation and reclamation that I would like to embody as a part of my remarks in connection with this measure, Mr. Chairman, if it is permissible.

The CHAIRMAN. If there is no objection, Mr. McFadden, that may be done.

(The matter referred to is here printed in full as follows:)

REMARKS OF HON. LOUIS T. MCFADDEN, OF PENNSYLVANIA, IN THE HOUSE OF REPRESENTATIVES, JANUARY 23, 1929.

Mr. MCFADDEN. Mr. Chairman, ladies and gentlemen of the House, I want to refer briefly to an occurrence in the House last Monday when the Consent Calendar was under consideration. I refer particularly to the colloquy had in respect to Senate bill No. 1462, when the gentleman from Washington [Mr. Summers] was questioned as to the then present consideration of the bill by the gentleman from Utah [Mr. Leatherwood], the gentleman from Utah asking the gentleman from Washington whether or not if the bill went over to the next consent day it would be called up for consideration later on. The answer was that it would be, and, if necessary, it was implied, that the bill would be considered under suspension of the rules.

I want to direct your attention for a few moments now as regards the question of expending the public money for reclamation projects in amounts such as are now taking place and as are apparently in immediate contemplation. It seems to me that it is very pertinent in connection with the problem for which the extra session of Congress is being urged, namely, the consideration of farm relief legislation and the tariff. Certain it is in my mind, if these lavish expenditures are to be continued to reclaim additional lands for the purpose of increasing agricultural production, when the Congress is being called upon to finance surplus production it is time that we paid some very definite attention to the details of these various projects and understand the economic effect that such action has on the country as a whole.

Mr. Chairman, I desire to ask the question, Should the Government now, under the circumstances, undertake reclamation of any additional lands?

In considering this matter let us briefly review the present status of Government reclamation work as reflected in official reports. Since creation of the Bureau of Reclamation, the Government has expended down to June 30, 1927, a total of $183,887,241 reclaiming so-called desert lands. In 1927 the irrigable area of projects built by the Government was 1,956,910 acres, an increase of 112,300 over that of 1926. The gross value of crops grown on these projects in 1927 was $72,047,200, an increase of $11,677,580, compared with 1926. In addition to the above areas, the Government's reclamation projects supplied, under the Warren Act, water to 1,482,950 acres in 1927, an increase over the previous year of 153,930 acres. The gross value of crops grown on this Warren Act land was $61,160,010, an increase of $11,409,970 over that of the previous year. From the foregoing it will be observed that the total value of crops grown in 1928 on the 3,439,860 acres of irrigated land, furnished with water from the works of the Bureau of Reclamation, was $133,207,210, an increase of $23,087,550 compared with 1926. In 1927 the Government appropriated for construction the sum of $9,869,000, compared with $4,443,000 the previous year, both figures exclusive of reappropriations. During 1927 there was expended on construction $6,966,449, compared with $5,189,025 of the previous year. All works now under construction involve a further ultimate expenditure of $90,000,000.

During the year the Guernsey Dam on the North Platte was completed; the Stony Gorge Dam on the Orland project in California was 90 per cent completed; the Gibson Dam on the Sun River project in Montana was 50 per cent completed; the work was under way on the construction of the Echo Dam under the Salt Lake Basin project in Utah, and on the Easton Diversion Dam, and other works of the Yakima project in Washington; preliminary work was begun on the Harper Diversion Dam and other structures on the Vale project in Oregon; contract was awarded and preliminary work begun on the structures of the Owyhee Dam, under the project of that name in Oregon. This last-named dam, when completed, will be the highest dam in the world, 43 feet higher than the 362-foot Schraeh Dam in Switzerland. The estimated cost of this Owyhee Dam is $5,378,125. The estimated cost of the dams and structures above mentioned, either completed or under way in 1927, is approximately $11,000,000.

The Crisp bill, H. R. 8221, contemplates expenditure of $10,000,000 in the purchase of "swamp, cut-over, neglected, abandoned, or poorly farmed land"

in 10 Southern States, and in the creation therefrom of not less than 2,000 demonstration farms to aid, so we are told, in the settlement of waste lands. The Columbia Basin bill, S. 1462, contemplates irrigation of 1,833,000 acres at preliminary cost estimate for construction of works of not less than $315,000,000.

Twenty-four Government reclamation projects are already in operation, with the products therefrom competing with those of agriculture produced from lands privately reclaimed.

This Government reclamation work has always been under the control of the Department of the Interior. The historical policy of the Department of the Interior has been to dispose of more lands to settlers. Under existing conditions the policy of the Department of Agriculture is to advise the curtailment of new land settlement and production of more crops—especially of those whereof we annually create a surplus. Is it sane for this Government to induce settlement of raw lands for further production at a time when it is urged that because of surpluses year after year the market prices for staple crops have been ruined? As a matter of fact, it is well known that for a long time past new settlers which the Government has been able to induce to occupy raw lands under these reclamation projects have mostly been either those little versed in farming pioneering or those who have through many inferences, and not a few positive relief acts of the Government, been led to believe that eventually the cost of reclamation charged against them will be canceled. The adjustment and relief furnished these settlers in the last fiscal year amounted to the sum of $5,613,750.36. For 15 years the Bureau of Reclamation has been struggling with little success to secure settlers on the Milk River, Lower Yellowstone, the Belle Fourche, and some of the other projects. In the 1928 annual report of the Secretary of the Interior appears the following with reference to the Milk River project:

"Efforts to secure settlers for unimproved land have failed. * * * The urgent need of this project is to secure more good farmers and place them on partially improved farms under conditions where they will succeed."

In the same report, referring to the Lower Yellowstone project, the Secretary states:

"It has been found almost impossible to dispose of any unimproved farms without buildings. * * * The urgent need is for creation of an agency which will make and finance these needed improvements on long terms and at a low rate of interest. * * * Those who have unimproved farms and who are in the greatest need of assistance can not get Federal aid."

In the same report, referring to the Belle Fourche project, the Secretary reports an increase of—

"Sixty-two resident operators over the low point of 1925. * * * These newcomers are principally tenants."

One of the objects of the Government undertaking reclamation work was to give the poor but worthy and aspiring farmer an opportunity to become a land owner, but apparently the conditions surrounding the reclamation efforts of the Government have all conspired to produce an increasing tenantry, instead of ownership. Thus, in 1927, we find that 39 per cent of the farms in the Yuma project were cultivated by tenants; that of the 1,768 irrigated farms under the Uncompahgre project in Colorado, 850 were cultivated by owners and 918 by tenants; that of the 182 irrigated farms in the King Hill project in Idaho, 121 were farmed by owners and 61 by tenants; that over 40 per cent of the farms under the Boise project were cultivated by tenants, and that tenancy in the Minidoka project increased from 41 to 44 per cent; that of the 584 cultivated farms under the Huntley project in Montana, 309 were cultivated last year by owners and 275 by tenants; of the 500 farms cultivated last year under the Milk River project, 262 were operated by owners or managers for owners, and 238 by tenants; that under the Lower Yellowstone project, farm owners cultivated 270 farms and tenants 332; that under the Carlsbad project in New Mexico, 288 farms were cultivated by owners and 137 by tenants; that of the 4,669 farms in the Rio Grande project in 1927, 2,901 were operated by owners and 1,768 by tenants; that under the Shoshone project in Wyoming, 343 units were farmed by owners, and 241 by tenants, and so forth.

Moreover, already it has come to pass that thousands of allotted units under the various projects can not be advanced further for lack of settlers with capital for needed building improvements, operation, and so forth. Thus, under the Belle Fourche project, 400 farms, according the Secretary of the Interior, need building improvements before settlement can advance further, and, quoting his words:

"To accomplish desired results a credit fund of $500,000 should be made available for these Belle Fourche project landowners for construction purposes. No money is available in this vicinity for real-estate loans, and short-time bank loans are made only on productive livestock at 10 per cent interest."

In all these cases, the Government having induced the settlement, what is the duty of the Government toward these settlers? And what should be the policy of this Government to avoid in the future recurrence of these positions, where the settlers demand and procure no interest charges under their purchase contracts, reduction of principal price, delays in making first payments, longer periods of amortization, and so forth? In his 1928 annual report the Secretary of the Interior states:

"Few settlers have the capital required to convert a tract of raw land into a productive farm, the cost of improving, equipping, and operating farms having doubled in recent years. Hence the bureau is seeking a better type of farmer with more capital and skill."

It has seemingly now become the policy of the Bureau of Reclamation to desire to incorporate as a part of construction costs the preparation for immediate farming of at least part of the lands comprising the different units; that is, to clear and level such lands, and so forth. Such a step is reported as in accord with the recommendations of the different economic boards appointed to consider these newer projects.

These boards make land classifications, determine the size of farms, work out a program of agriculture adapted to the climate and soil, investigate cost of clearing, leveling, and preparing land for irrigation, make estimates of costs of buildings, fences, livestock, and farm equipment for minimum requirements, and also estimates of operating expenses and farm income; but when all is said and done, and representations as inducements to settlers to purchase have been made, based upon the findings of these boards, it would appear that at least in several instances, were the Government an individual and had it as an individual promoter utilized United States mails for the making of such representations, it would have been subject to prosecution for the use of the mails to defraud. Such are the repeated reports from many settlers.

And has the poor but worthy farmer a chance under these new projects? Dr. Alvin Johnson, recently employed by the Bureau of Reclamation as a social and economic expert, says concerning settlers' conditions under one of the later projects:

"What they have now, what the bounty of the Government has given them, is only a Chinaman's chance—i. e., they have a chance, by subjecting themselves and their wives and children to a Chinese standard of living through four or five years, to come into the birthright of ordinary American citizens—an American standard of living."

Some time ago Congress was driven to the point where it prescribed as a condition precedent to the making of an allotment the possession by the contemplating settler of $2,000 in cosh or its equivalent in livestock and equipment. Do these projects now being constructed or those contemplated in pending legislation offer possibility of success to a settler thus equipped? As an example, let us consider this big new Owyhee project. There the economic board reported that a settler with $2,500 capital could not succeed with even as small an allotment as 40 acres; that even were a settler with $2,500 placed on a 40-acre tract wholly cleared and one-half planted to perennial legumes he could succeed only with the aid of the land bank. And it is well known there is no Federal aid for the settler who finds himself thus situated.

No wonder that even though the Reclamation Bureau should now go into the business, added to its other undertakings, of clearing and leveling the land, or go so far as to plant a part of the land, the great difficulty of securing settlers would still exist. This bureau employs competent agents trained in settlement work and the science of irrigation farming, but they can not find these settlers who have, as they should have, according to the findings of these economic boards, from $7,500 to $10,000 to develop a 40-acre dairy tract.

It may be all right for the Congress to say that settlers with $2,000 in capital may be allotted units in these projects, but where can these settlers borrow an additional $5,500 to $8,000 to bring the smallest of these tracts into production? The Federal land bank makes loans only on developed farms from which the income is immediate and assured. Local banks can not make long-time loans. The director of reclamation economics of the Bureau of Reclamation in

an address before the Oregon Reclamation Congress at Salem, Oreg., on November 15 last, stated:

"No one is optimistic enough to believe that settlers can be secured with from $5,000 to $7,500 in sufficient numbers to settle these large areas of unimproved land rapidly enough to pay operation and maintenance charges and construction charges which will follow soon after the construction of irrigation works."

There is no hope for State aid because investigation shows that in most States there are constitutional prohibitions against the giving of aid of such a nature, although experience has shown that the States wherein these projects are located are the chief beneficiaries of the Government's expenditures; that these nearly worthless desert lands, producing little or no taxes, are upon reclamation and settlement taxed locally upon high assessed valuations.

The value of the Government's lien on the lands in these projects depends wholly on settlement. In a farm-depression crisis like the present, shall the Government which has thus unwittingly gotten into business, proceed to settle this land effectively and create competing crops, by forgiving debts, delaying initial settlements, prolonging amortization periods, and so forth?

But what shall be said of a contemplated undertaking like that mentioned above in the Columbia River Basin, which involves an outlay equal to twice the total sum expended to date on all other projects put together—a sum equal to the structural costs of the Panama Canal? No matter what may be said as to the length of time involved in the construction of these great contemplated works, there can be no argument that at the end of such a period the lands thereunder will be required for production. The quickness with which pasture lands and cut-over wood lots responded to the war demands for production taught us that unless it can be vouchsafed there will be a huge demand for exports, we have nothing to fear from scarcity of supply for our normally increasing domestic population.

From time to time there have been more or less half-hearted efforts made to stop this orgy of expenditures through the Bureau of Reclamation, but action taken has always been insufficient. Only the other day the new Secretary of the Interior approved a large item of expenditure for new construction under an Idaho project involving creation of a power plant. It is interesting to note that as a side line in this reclamation business the Government is in the power business, and that last year it sold surplus electrical energy under 50 contracts, receiving $654,564.37.

In the report of the Secretary of Agriculture to the President, dated November 3, 1927, we read:

"Although, like Canada and Australia, we formerly found it desirable to employ our land policy as a means of attracting immigration, we are now endeavoring to restrict immigration. Unlike some of the densely peopled countries of Europe, our output of farm products adapted to the climate is adequate; and we have no scarcity of agricultural land. Although the Federal Government has disposed of practically all the lands of agricultural significance formerly in the public domain, there is still a vast area of potential crop land in private ownership. This area is estimated at more than 600,000,000 acres. A large proportion of this is fair to good land in woodland areas where only clearing is necessary. Such land, as well as large areas of potential crop land in semiarid regions, awaits only a sufficiently stimulating price for farm products to be brought quickly under the plow. In fact, this privately held land exerts at times an unfavorable influence on agricultural prosperity. * * * Temporary increases in farm commodity prices cause some of it to be brought into cultivation, and when prices fail there is no ready contraction in the new farm areas because of the difficulty of transferring the labor and capital put into them to other industries. Short-sighted expansion of the agricultural area in times of temporary prosperity is encouraged, moreover, by the potent influence of supersalesmanship exerted in the interest of land-selling agencies. * * * Experience has shown that when the outlook is sufficiently promising private enterprise can be depended on to reclaim new areas. * * * There is need for a comprehensive study of reclamation policies and of the reclamation projects now under construction or contemplated. The policy of giving settlers on Federal reclamation projects from 20 to upward of 40 years to repay construction charges without interest constitutes an extensive subsidy to agricultural expansion. * * * It was estimated in 1923 that on the basis of the terms of repayment of interest then existing the exemption of interest at 4 per cent amounted to nearly 46 per cent of the cost of construction. Since

then the period of repayment has been greatly extended and the subsidy correspondingly increased. As no corresponding subsidy is enjoyed by private enterprise in the development and utilization of agricultural land the settlers on Government projects are given an important competitive advantage. * * *

"Federal activity in the promotion of farm-land expansion seems particularly unwise when we reflect that a number of Federal reclamation projects are suffering seriously from depression aggravated by heavy overhead charges growing out of high costs of construction. * * * In general, proposals to enlist the funds and initiative of the Federal Government in stimulating agricultural expansion must cause concern to all persons interested in the farmer's welfare. With a huge reservoir of potential agricultural land, and strong forces tending constantly to stimulate expansion of the farm area, our land problem at present is not how to force land under the plow as rapidly as possible, but how to achieve a wise and economical allocation of our available land among major uses, such as crops, forests, and extensive grazing, and in such a way as to make farming on that land profitable."

How can we coordinate this constructive criticism with the promotion ideas of the Bureau of Reclamation? Mr. Chairman, it can not be done. Either we are to bury farming deep and for decades to come under these huge contemplated land-reclamation projects like Boulder Dam and Columbia River, or we will, statesmanlike, hold these vast competitive resources in reserve and undeveloped until such time as, stimulated by assured profits from farm production, settlers seek these lands at prices and on terms which will justify the employment of private capital to construct the necessary works. A not unimportant feature of any program of farm relief must be the forsaking by the Government of all thought of additional land reclamation. The so-called "revolving fund" of the Bureau of Reclamation now consists of approximately $166,000,000, invested in long-term loans to settlers. As the payments under these loans are collected, they replenish this revolving fund, and thus such payments support new construction. Moreover, to such revolving fund is allocated a part of the funds received by the Government from sale of public lands.

Last year such allocation amounted to $705,822.66. Moreover, 52½ per cent of all cash received by the Government as royalties from oil leases goes to this revolving fund, and thus last year this revolving fund was increased $2,454,168.66 from such source. The total payment by settlers into this revolving fund last year was $5,299,149.55. Omitting such large items as income from sale of surplus power, rental of water rights, and so forth, and yet there flowed into such revolving fund during last fiscal year nearly $10,000,000. When farming credit is not to be had and finances are needed for moving crops the farmers of this country can not understand their Government's diverting such funds year after year to the subsidizing of competition; nor can they understand the righteousness of their Government supporting an Agricultural Department advocating one policy and an Interior Department actively engaged in defeating such policy.

This question of further reclamation of arid lands is the least complex of any which will be presented for our consideration in formulating a correct legislative program for farm relief, but it is doubtful if even it can be correctly, thoroughly digested and solved by proper enactments at this session. Opportunity should be given for full presentation and consideration of all facts. I hope my remarks may put on notice those who would defend at the contemplated extra session the policy of further reclamation of lands by the Government.

Mr. SUMMERS of Washington. Mr. Chairman, will the gentleman yield?

Mr. MCFADDEN. Yes.

Mr. SUMMERS of Washington. I want to say that the bill to which the gentleman referred, which I had charge of on last consent day, does not contemplate at this time a reclamation project. It contemplates some investigations which must necessarily cover a number of years. The first unit of that project, when finally decided by the Bureau of Reclamation to be a feasible project and approved by the Congress and constructed, would go into cultivation about 20 years from now; and under the plan now contemplated the whole project would be developed in the course of about 40 years, when the population of the United States would be about 60,000,000 in excess of what it is now.

The production from that proposed project would take care of 1,000,000 of the 60,000,000 of increase, and would not interfere with consumption by the present population, nor of ten, twenty, thirty, forty, or fifty million of the increase in population. That project would only meet the needs of one-sixtieth of the increased population.

Mr. McFADDEN. Yes; but I say to the gentleman that this bill is the nose of the camel under the tent, and this will eventually involve a total expenditure on the part of the Government of probably $350,000,000.

Mr. SUMMERS of Washington. No such draft on the Treasury is contemplated by those in charge of the project.

Mr. CRAMPTON. Will the gentleman yield?

Mr. McFADDEN. I will yield.

Mr. CRAMPTON. I was not so fortunate as to hear all of the gentleman's remarks, but only the latter portion of them, in which I thought the gentleman raised the question as to the advisabiliy of utilizing power developed as an incident to irrigation work. Is that the position of the gentleman?

Mr. McFADDEN. I was referring to the receipts from the sale of power originating on these propositions——

Mr. CRAMPTON. Prior to that the gentleman made the remark about the Government going into the power business, and I got the very general impression the gentleman felt we ought to discontinue more——

Mr. McFADDEN. No; I was simply giving facts in regard to the returns on these developments indicating there was power developments coupled with the reclamation projects, the total income being some $600,000 last year.

Mr. CRAMTON. But prior to that?

Mr. McFADDEN. I was not specifically criticizing the developing of the properties once they had been acquired, and my remarks were directed generally to the policy of these large appropriations for the construction of reclamation projects, especially since the Congress is now about to take up the problem of dealing with the surplus products of the farms, and because we all know and understand that these great areas, so watered by these projects and otherwise improved, are produced in direct competition with the farm products of the whole country.

Mr. CRAMTON. I got that. I was more concerned about what seemed to be a criticism of the appropriations which have been passed by this House in reference to reclamation and the power developed in Idaho, for instance.

Mr. McFADDEN. I will say I believe much of that could be dispensed with at the present time, particularly when we are called upon to inaugurate a policy to provide for the marketing of the surplus products of the farms of the whole country.

Mr. CRAMTON. Just where would the gentleman draw the line as to the completion of the projects under way for furnishing needed water to settlers now on the land?

Mr. McFADDEN. If I was in charge I would have an examination made by proper engineers to determine what was best to do under the circumstances.

The CHAIRMAN. The time of the gentleman has expired.

Mr. McFADDEN. And the sooner we get at it the better.

Mr. SIMMONS. I will yield the gentleman five additional minutes. I understand the gentleman's statement is that these reclamation products are in direct competition with the rain-belt farmer and the other farmers throughout the country?

Mr. McFADDEN. I do not know that I included rain-belt farmers particularly.

Mr. SIMMONS. With the general products of the country?

Mr. McFADDEN. I am talking in connection with contemplated action being demanded for laws to govern marketing of the surplus crops of the farmer, and I will say to the gentleman all of these reclamation projects certainly produce agricultural products which come on the market and into competition with production, which is one of the reasons that necessitate action at this time, or at least Congress is being pressed for action at this time to solve the farm-relief problem.

Mr. SIMMONS. On part of it the gentleman is in error, because the agriculturists on reclamation projects of necessity become specialists in farm production. Some are fruit farmers, of which there is no surplus in the United States. The project in my State is largely devoted to the growth of sugar beets, of which sugar there is no surplus in the United States. Following, the next crop is alfalfa, which is used with the refuse from the beets. We devote it to feeding cattle especially and that type of farm activities. I think a fair check on the reclamation projects of the country will develop that a great many of the products are not in competition and can not create a surplus in the United States.

Mr. McFADDEN. I appreciate what the gentleman says.

Mr. CRAMTON. If the gentleman will yield, the gentleman referred to that Idaho expansion. The largest expansion provided for in the pending Interior Department appropriation bill was in connection with the Minidoka project to furnish a supplemental water supply to the Gooding unit that is already developed. The settlers are there but are unable to prosper because of an insufficiency of a certain water supply. In such cases as that the gentleman does not ask that these settlers of Idaho should stay there and remain in deplorable financial condition just so that the farmers of Michigan and Pennsylvania shall prosper? Idaho is as much a part of the United States as Michigan and Pennsylvania.

Mr. MCFADDEN. Oh, no. I only hold that Congress, when it deals with the general question of farm relief, should take reclamation into consideration as one of the factors involved.

Mr. JACOBSTEIN. Mr. Chairman, will the gentleman yield?

Mr. MCFADDEN. Yes.

Mr. JACOBSTEIN. I thoroughly agree with what you say about the looseness in our uncoordinated policy. The Department of Agriculture advocates one thing and the Department of the Interior another. Should not these projects so far as the production of agricultural products go, be O. K.'d by the Agricultural Department before we proceed with them?

Mr. MCFADDEN. Yes; I think so.

Mr. JACOBSTEIN. At present we have no coordination in the matter. As it is now the farmers' organizations themselves have recently gone on record in affirming the position of the gentleman from Pennsylvania.

Mr. MCFADDEN. Yes. There is one organization that I have specifically in mind. The National Grange are upon record in support of my suggestion.

Mr. STEVENSON. Mr. Chairman, will the gentleman yield?

Mr. MCFADDEN. Yes.

Mr. STEVENSON. The gentleman from Nebraska (Mr. Simmons) enumerated several projects that he said would not be in conflict with the policy of preventing a surplus, as producing products in which there is no surplus. The Boulder Dam proposition was one where we were going to irrigate an enormous amount of land there to produce cotton. That, of course, would be in live competition with one of our basic crops.

Mr. MCFADDEN. Yes. And the lands now made available for irrigation in Mexico will affect the growers of cotton in South Carolina, and if these cotton lands get into full production not only South Carolina will be affected but the whole South, because under existing conditions in Mexico cotton could be produced much cheaper than in the South, because of irrigation and cheap Mexican, Chinese, and Japanese labor.

Mr. JACOBSTEIN. The gentleman from Nebraska refers to fruits as not having a surplus. But we do have at times a surplus of fruits.

Mr. MCFADDEN. Yes.

Mr. MCFADDEN. I understand that in the particular project now under consideration—this Columbia River basin project—the thought has been diverted from an irrigation project to a water-power undertaking, which is, I understand, to be developed first. Nevertheless, I understand that it is in contemplation to make this water available as soon as possible for irrigation purposes, and that the Government is to grant loans therefor.

We seem to have engaged in an orgy of indirect aid and assistance to projects of this kind. One of my main objections to these plans is the fact that in the first instance an investigation is provided for; reports are made, and then in a year or two additional appropriations are authorized, and the first thing the Government knows it is committed, over a term of years, to a project, either by direct appropriations or through loans, and if a curtailment is attempted it is pointed out by those who are interested in these projects how utterly impossible and foolish it is to attempt to stop these operations. And so, little by little, in an apparently innocent way, we are drawn into these projects, which require large appropriations and bind the Government eventually to larger expenditures and commitments.

That is particularly true in this instance. Now, while I understand that money is to be loaned and interest is to be paid, much in the same manner as is being done in the Boulder Dam project, at the same time it is a committal. I think we have got to watch very carefully such committals on the part of the Government in times like these.

Mr. LOOFBOUROW. Mr. McFadden, might not the same argument be made against drainage projects, where we are draining land or protecting land from the overflow of large waterways? Because by protecting the land from the water we are making it available for agricultural purposes.

Mr. MCFADDEN. I suppose to a certain extent that is true; yes.

Mr. SMITH. That is especially true in the Mississippi valley, where even now they are trying to get an appropriation.

Mr. MCFADDEN. Yes; I agree with you on that.

Mr. OVERTON. Don't you think there is a distinction between a situation of that kind and the one we are now discussing? In the case of flood control aid by the Federal Government you have farms that are already under cultivation, and have been for years; you have towns and you have cities, and you have a country that is thoroughly well developed, and has been, and with the increasing flood waters that country is subject to devastation, with loss of farm products and of property and of lives. In this particular case we are undertaking a new development; to bring into existence lands for production that are not producing now. One is protection, and the other is, according to your theory, an unnecessary development of agricultural resources. Don't you think that distinction should be made?

Mr. MCFADDEN. Yes; I do think that. And, of course, in this particular development, as I look at it, and from information that I have, there is in process the building up of a big settlement in connection with it. Real estate is involved to quite an extent. It looks to me as if there are elements of speculation involved in this project, and on that account particularly it should be avoided, because in these times we must recognize the fact that in Congress, with not only this kind of legislation but a lot of other legislation—for instance, take the legislation the other day dealing with grasshoppers—we are trying to repeal natural laws. We are attempting to repeal the law of supply and demand, God's method of dealing with surpluses.

Mr. SMITH. Mr. Chairman, I want to ask Mr. McFadden a question with reference to the improvement on the Mississippi. The money expended there does not contemplate that the Government will be reimbursed as far as the interest is concerned or as far as the principal is concerned. It is an outright expenditure out of the Federal Treasury, as I understand it.

Mr. OVERTON. That is it.

Mr. SMITH. Without any intention of repaying.

Mr. OVERTON. That is correct.

Mr. SMITH. But in this case the Government is not only repaid the amount advanced, but is repaid with interest. As far as the grasshopper situation is concerned——

Mr. MCFADDEN. I was simply using that as an illustration of what we are doing here.

Mr. OVERTON. It occurred to me that there was quite a distinction in the thought that was then being developed.

Mr. SMITH. Yes; that is right.

Mr. OVERTON. And I was pointing out that distinction.

Mr. SMITH. But as far as grasshoppers are concerned, if you will take the trouble to look at the Congressional Record for last Saturday, you will find a statement there from the Department of Agriculture that for every dollar that has been expended for the last 10 years in trying to control the grasshopper scourge it has saved over a hundred dollars, and in some places a thousand dollars, because by expending a little money to control the grasshoppers before they are hatched you prevent them from spreading all over the country.

Mr. LOOFBOUROW. Mr. Chairman, if the grasshopper argument is good, why not just cut out the Department of Agriculture entirely and have nothing to do with encouraging or protecting agriculture?

Mr. ARENTZ. The same argument will apply to flood control. A flood is an act of God. The rain comes down, and floods come and overflow the land, and there is a smaller crop than we otherwise would have had.

Mr. OVERTON. Yes; but I think there is this further distinction: That the Federal Government undertook flood control not simply to develop the agricultural resources of this country or to sustain agricultural resources already in existence, but it has undertaken flood control because by reason of the breaking of these levees there is a disaster not only to agricultural products but to lives, and whole towns and communities and cities, such as New Orleans, are threatened with devastation.

Mr. LOOFBOUROW. That is the whole meat of it.

Mr. OVERTON. Yes; and since the cause of these overflows is not to be attributed to the particular locality which is the subject of this devastating influence, but is due to the fact that this water is being drained from, I think, 41 per cent of the territory of the United States and brought down the Mississippi River into Arkansas and Mississippi and Louisiana, the Federal Government felt that it was its duty to undertake to protect it.

Mr. LOOFBOUROW. It is not all a matter of flood control; it is all bound up together.

Mr. OVERTON. Exactly.

The CHAIRMAN. And in the case of the Mississippi Valley the important question of water navigation is involved, over and above this project.

Mr. OVERTON. Yes.

Mr. LOOFBOUROW. Now, suppose we let Mr. McFadden have the floor.

Mr. MARTIN. We might withdraw the part about the grasshoppers.

Mr. MCFADDEN. I would include that, instead of withdrawing anything; also the appropriation which Congress made for the Mediterranean fruit fly in Florida. Congress is continually responding to appeals for the control of natural developments. Grasshoppers, and so forth, and the law of supply and demand is apparently nature's way of controlling surpluses, and I do not believe that you can control nature by legislation.

Mr. SMITH. You would not oppose the appropriation for boll weevil eradication, would you?

Mr. McFADDEN. I think we have appropriated lots of useless money in that respect.

Mr. SMITH. And the cattle tick, and all those things?

Mr. McFADDEN. I refer again to the appropriations that were made a few years ago for the hoof-and-mouth disease in the State of California.

Mr. SMITH. That was money well spent.

Mr. McFADDEN. I was told by men from California that it was a very serious question whether there really was any hoof-and-mouth disease out there. They had a surplus of cattle to sell.

So, as I say, Congress is being besieged by a lot of these developments, principally as promotional schemes, and I think we have reached the point where we have got to stop.

Mr. SMITH. You would abolish the Public Health Service, if you argue against the control of the foot-and-mouth disease?

Mr. McFADDEN. Oh, no; this is entirely different from the Public Health Service.

Mr. SMITH. No, indeed; it is on the same line exactly.

The CHAIRMAN. Mr. McFadden, what is your remedy for the unemployed in this country? We have got eight or ten million people now in the cities, and industry has reached its saturation point. What is your theory for taking care of these surplus people?

Mr. McFADDEN. I would like to go into an economic discussion of the unemployment matter, but I think it is quite aside from this development of a water power and irrigation project in the State of Washington.

Mr. SMITH. Mr. McFadden, I do not know whether or not you opposed the other day a little bill that was brought up in the House by Mr. Swing of California, simply to get the right of way over the public lands, but some of the men who were associated with you in your opposition to irrigation and development stood there on the floor and opposed that—notably Mr. Stafford—and it means that when that law is signed by the President over 10,000 men will be put to work in southern California to put in a great aqueduct.

Mr. LOOFBOUROW. Those are just water lines; pipe lines?

Mr. SMITH. Yes; and yet on the floor of the House we had a big fight to get a little right of way over the public lands.

The CHAIRMAN. Proceed, Mr. McFadden.

Mr. McFADDEN. I have a letter here from Kennewick, Wash., that I want to read some extracts from. It is from a man who says that he has lived in Washington for 33 years, and he writes quite lucidly in regard to this project.

Mr. SMITH. I suggest that you put the whole letter in the record.

Mr. McFADDEN. Without objection, I will put the whole letter in the record, without reading it.

The CHAIRMAN. If there is no objection, it may go in the record.

Mr. ARENTZ. According to Ed Taylor, that is going to cost $8 a page.

Mr. McFADDEN. Well, we will let it go in. I think it is worth $8 a page.

Mr. SUMMERS of Washington. What is the date of the letter?

Mr. McFADDEN. February 23, 1929.

Mr. SUMMERS of Washington. That is back when it was an irrigation project?

Mr. McFADDEN. Yes.

Mr. SMITH. Who signs it?

Mr. McFADDEN. Edwin Layton, of Kennewick, Wash.

I do not want to take up the time of the committee if you do not want to listen to it.

The CHAIRMAN. Go ahead and read it, Mr. McFadden.

Mr. McFADDEN. This is what he says:

KENNEWICK, WASH., *February 23, 1929.*

Representative McFADDEN,
Washington, D. C.

DEAR MR. McFADDEN: I inclose clipping which explains itself. The flood of poppycock and bunk spread by advocates of the Spokane pork-barrel ditch grab in Washington, D. C., has thoroughly disgusted every unprejudiced man, woman, and child in the State of Washington who is able to think straight. Is there no way to stop this disgusting monkey business? Not a single logical reason can be advanced for starting surveys, etc., at this time. I feel that the truth should be known in relation to this brazen attempt to dive head first into the Federal Treasury on the strength of a designing agitation which is easily a good 50 years ahead of time.

The attention of eastern Senators and Representatives should be called to the fact that this absurd ballyhoo for a colossal ditch system to replace the present mode of farming and livestock husbandry in certain parts of Adams, Grant, Franklyn, and Walla Walla Counties (eastern Washington) was hatched in Spokane about seven or eight year ago by Spokane people with the perfectly splendid idea that it would "do something for Spokane." The big idea is that heavy Government appropriations of money strung over a period of 25 or 30 years would be a lifesaver for Spokane, a town which has been in the doldrums for some years past. The schemers evidently infer that Spokane would be made the headquarters for the distribution of pie and this is correct in case the steal goves over. I use the word "steal" advisedly, as I consider it the correct term to this impudent and monstrous attempt to secure Federal appropriation of real money.

Now, I have lived here in eastern Washington for 33 years and am well informed from personal observation and experience as to the physical features of this area in question and the various economic factors concerned. I have particularly noticed that the Spokane Review has been very careful to omit any reference to a number of very vital facts concerned with this plan to wheedle money from the Federal Government.

Eastern people should understand that the per-acre estimate of cost on the proposed pork barrel ditch runs from $157 to $200 per acre. I have seen no estimate quoted lower than $157. This would cover the bare cost of construction only.

It must be realized that land under an irrigation project is in no sense of the word ready to farm merely because a ditch has been built and kept filled with water. The fun has not even commenced for the gentle sucker who has decided to go busted via the 10-acres-of-apples route. His land is still to be cleared and leveled, and leveling is a very tedious, expensive process. Good land under old-established irrigation projects here in east Washington, fenced, flumed, leveled, under a state of cultivation, provided with boulevards, wells cross fences, improvements generally, on paved roads, mail routes, school, bus routes, etc., can be had (and plenty of it) at from one-fourth to one-half of the estimated cost per acre of building the ditch alone on the proposed Spokane pork barrel project. Also, these places are near towns and close to all kinds of railroad facilities in old, settled communities.

An enormous amount of irrigated land here in Washington and Oregon (and presumably elsewhere) has gone back to the ownership of districts, etc., through delinquent taxes. This is an old problem and a serious one. On occasion bondholders have brought suit to enforce payments. Such a suit (Richmond irrigation district) was recently decided by our supreme court at Olympia. One thing should be very thoroughly understood and that is this:

The proposed ditch scheme, if carried out, would merely change the mode of farming over the area affected. It might not even do that, as no law could force the farmers now farming this land to flop over from the present system of farming to another and far less profitable system. Please bear in

mind that the farmers and stock raisers now living on this alleged "project" have been cultivating and grazing these lands ever since east Washington had railroads. These are deeded lands, not a part of the public domain—not an unproductive area—is now, and has been for at least 40 years, a heavy producer of grain and livestock and this land is all used for wheat and livestock at the present time and for many years past.

It would seem that the best way to head off this raid would be to acquaint eastern people with the facts in the case, cutting out the cheap poppycock and lying bunk as we hear it here from the Spokane "boosters" so called. I have yet to meet a single person who has looked carefully into all the features of this case and is not selfishly interested himself, who is in favor of it. The animus behind this grab is well understood here but Spokane "boosters" do not like to hear this phase of the matter discussed.

The amazing size of this graft and the cool impudence of its proponents is astounding. The boom we "enjoyed" here in east Washington from about 1902 to 1906 or thereabouts is unforgettable. The spring sucker runs were enormous, overland trains often running two sections. Wildcat schemes of all kinds flourished on newly opened irrigated tracts. The collapse was compared to the present plan to graciously permit Uncle Sam to rejuvenate Spokane with a 25 or 50 year pension.

Very truly yours,

(Signed) EDWIN LAYTON.

Mr. SMITH. Have you any information as to this man's business or his antecedents?

Mr. MCFADDEN. No; I have not.

Mr. SMITH. Or whether he is a resident of the town?

Mr. MCFADDEN. Well, he writes very intelligently.

Mr. SMITH. Oh, yes; but I was just curious to know.

Mr. MCFADDEN. I have another letter here, written January 17, 1932. [Reading:]

KENNEWICK, WASH., *January 17, 1932.*

Hon. LOUIS T. MCFADDEN,
Washington, D. C.

DEAR SENATOR: I am writing you in regard to the antics of the up-and-at-'em lads from Spokane in their frenzied attempts to put across their appropriation grab. The latest local dodge is laughable in its puerile innocence; Spokane newspapers propose calling the visionary dam in their fantastic ditch grab "Mead Dam." This stroke of genius, they figure, should go far in putting over their so-called "Columbia Basin project." We may now look to see Commissioner Mead bust his suspenders in efforts to foist this colossal proposed graft onto the farming fraternity. I wonder if eastern and mid-West farmers realize how important their help is in checking useless and costly irrigation schemes. We can not stop it from here. Irrigation projects are a political proposition—absolutely so. Farmers are not crying for more land. I have talked with hundreds of western people on this subject and the average opinion seems to be that it will take at least 50 years to utilize projects already started.

As a matter of fact, a few projects have already been abandoned. Why pester ourselves with so-called "problems" which belong to posterity only? I can easily understand that you are being fed some terrible bunk in Washington by the proponents of this impudent proposed bill. I noticed a list of "talking points" in a Spokane paper the other day. Among this piffle it was stated that "Mead Dam" would serve as a means of flood control. This bunk would bring tears to the eyes of a wooden Indian. The Columbia River is not a flood stream—is not subject to floods—flows its entire course from its source in Columbia Lake, British Columbia, through and near mountains to the sea—has no delta—flows through no alluvial plains as does the Ohio, Mississippi, etc.; has a swift current and high rocky banks; at no place in its course is it over 30 or 40 miles from mountains, and most of its course directly through them. We have no Imperial Valley below sea level; no flat plains. This "flood control" poppycock reminds me of the South Dakota citizen who pestered the Government engineers in 1925 with a scheme to avert the great Mississippi River floods by constructing a dam across the Missouri River in South Dakota to hold back the waters from Montana. Finally an engineer informed him that according to the flood-gage measure-

ments on the lower river his expensive dam would hold back the flood menace just 17 minutes. I can see no practical solution for the irrigation graft except to place the Reclamation Service in the Agricultural Department where it properly belongs. The land speculators, corner-lot specialists, transportation people, and all those selfishly interested in the spending of huge sums of Government funds over a long period of years will naturally bend every effort to have Congress recognize this so-called "project."

The power aspect of the bill is too absurd for comment (sale of power). This whole nasty mess was started 10 years ago in Spokane, by Spokane rooters, "for what it will do for Spokane," as one of them plainly told me at the time. I can not understand the attitude of Secretary Wilbur. He should know better. His attitude is a puzzle to me. He qualifies his statements by saying "sooner or later." Let us hope it will be later. I am not opposed to Spokane. I am opposed to a brazen effort to club the farming element in favor of a bunch of impudent boomers. These plug-uglies do not expect to live on the land. They know that a steady stream of Government dollars for the next 40 or 50 years would be a meal ticket for Spokane.

This is the whole story.

Very truly yours,

EDWIN LAYTON.

Mr. SMITH. Is that the same Layton that wrote the other letter?

Mr. MCFADDEN. Yes.

Mr. SUMMERS. Have you some more of those, Mr. McFadden?

Mr. MCFADDEN. These are a couple that I just picked out in a hurry to get down here.

Mr. SMITH. They are both from the same man?

Mr. MCFADDEN. Yes; they are both from the same man.

I want to protest as vehemently as I can against this proposal, because I think it is unfortunate to come up at a time like this, when the Public Treasury is strained to the extent that it is; and I can see no difference between the advancement through a loan and the advancement by an appropriation through the Treasury.

Mr. SMITH. Have you read the bill, Mr. McFadden?

Mr. MCFADDEN. Yes; I understand the bill.

Mr. SMITH. You know that it does not contemplate any expenditure or any appropriation until certain conditions have been complied with?

Mr. MCFADDEN. Oh, yes; it goes through the general course.

Mr. SMITH. Sale of power and things like that?

Mr. MCFADDEN. Yes; I understand that.

Mr. SUMMERS. Mr. Chairman, I would like to ask Mr. McFadden this question: Perhaps you have not seen the report from the Director of the Budget and the Secretary of the Interior, both of whom say that this is not a matter for present procedure, unless it be the preliminary legislation which would enable the signing up of power; that as far as a real appropriation of any kind is concerned, it is all a matter of the future; that the Federal Treasury is not in condition—and we recognize that, of course—to stand anything of this kind. That is set out very plainly by the Director of the Budget and by the Secretary of the Interior.

Mr. MCFADDEN. Yes. I recognize the fact that this plan has been under consideration here, and has in the past been pressed as an irrigation project, and now, when the situation and the demand for it have changed a bit, it comes up as a water-power proposition. It was having pretty hard sledding as an irrigation project, but in the background there is still the irrigation proposition, and I con-

tend that this is simply the nose of the camel under the tent, so to speak, and that eventually the Government will have to pay.

Mr. SUMMERS. The point I was making is that there is no appropriation contemplated at this time, and that the Director of the Budget and the Secretary of the Interior both have said in their letters that it is all a matter of the future, when the condition of the Treasury is entirely different from what it is now.

Mr. MCFADDEN. Yes.

Mr. SUMMERS. You, of course, are not supposed to have followed each and every one of these details.

Mr. MCFADDEN. No; I have not, of course.

Mr. SUMMERS. I simply wanted to bring that to your attention, in fairness.

Mr. MCFADDEN. I do not want to speak in regard to the details of this thing. I merely desired to record, as a general principle, my opposition.

Mr. FULBRIGHT. Mr. McFadden, are you acquainted with the author of these letters that you have read?

Mr. MCFADDEN. No; I am not. He has been a correspondent of mine for several years, but I am not personally acquainted with him. I was impressed, however, by his frankness and his statement of that particular angle of the question as a person living in that vicinity.

Mr. FULBRIGHT. If what he says is true, of course this is a bad bill.

Mr. MCFADDEN. Yes.

Mr. FULBRIGHT. There is no question about that, but I would like to know about how reliable he is, because Members of Congress have been getting letters by the thousands here recently.

Mr. MCFADDEN. I realize that; and as a general thing I do not give such letters too serious consideration. But this correspondent has been writing me on various subjects, and in particular reference to this he has indicated an intelligence and first-hand knowledge of conditions which has impressed me.

Mr. FULBRIGHT. Here is another question that I would like to ask: Does this proposed legislation contemplate opening up additional farm lands?

Mr. SMITH. It contemplates putting water on land that is producing to some extent under the dry-farming method.

Mr. FULBRIGHT. I would like to get right on to the green. Does it contemplate opening up additional farm lands?

Mr. O'SULLIVAN. In 25 years.

Mr. FULBRIGHT. If it does, let me suggest that I think this is a very bad time, if the farmer's condition is to be taken as a criterion to go by, to add further troubles.

Mr. SMITH. It would be 10 or 15 years, Mr. Fulbright, before the water could be made available.

Mr. FULBRIGHT. I have not assumed a position on this bill because I do not know much about it. But if it does contemplate the opening up of additional farm lands, and if it does contemplate additional appropriations at some time in the future, why the necessity of acting now rather than waiting until later to do it, if it is a meritorious program? That is the thing I was trying to get at.

Mr. HILL of Washington. Mr. Chairman, I think the question that the gentleman has asked is a very pertinent one, and I would like to make a brief statement.

The CHAIRMAN. We shall be glad to have you.
Mr. MCFADDEN. Thank you very much.
Mr. LOOFBOUROW. We thank you, Mr. McFadden, for coming.

ADDITIONAL STATEMENT OF HON. SAMUEL B. HILL, A REPRESENTATIVE FROM THE STATE OF WASHINGTON

Mr. HILL. Briefly, this bill proposes to authorize a project which will involve the building of a dam in the Columbia River for the purpose of producing power and also for the purpose of a reservoir for water to be used in irrigation at a future time.

It will require under the terms of the bill, first, that the Secretary of the Interior secure contracts for the power that is developed in sufficient amount to repay to the Government the cost of building the dam, with interest at 4 per cent.

Mr. SUMMERS. And the power project.

Mr. HILL. And the power project; that is, the dam and the power project, with interest at 4 per cent, before any appropriation can be made. It is estimated by the engineers it will take 10 years to build the dam and by the economists, working with the engineers, that it will require 15 years to absorb the power so that the maximum returns will be coming in from power to the Federal Government——

Mr. OVERTON. Is that 15 years after the dam is built?

Mr. HILL. After the dam is built; yes.

Mr. OVERTON. Making 25 years in all?

Mr. HILL. Making 25 years. At that time there will have accrued enough money from the power revenues to reduce the appropriation necessary for building the power plant and the dam, and the engineers say that the cost of this dam and power plant will be repaid within 30 years' time with $144,000,000 of additional money to be applied toward the reclamation of land that will follow. At the end of the period of 25 years from the time the construction of the dam is begun, it is contemplated that they may bring in the first unit of reclamation. That will be a small unit of 20,000 acres and then following along in units of 20,000 acres, or small units, until this land is reclaimed, which will take it to about the year 2000; and before any reclamation can be begun the Secretary of the Interior must secure contracts which, together with power revenues that will be applied to reducing the cost of reclamation, will repay the Government the total expenditure for the reclamation project.

Mr. FULBRIGHT. Where are they getting their power now?

Mr. HILL. This is new power. This will be a new development.

Mr. FULBRIGHT. What industries or business interests there would utilize the power?

Mr. HILL. Statistics show that there has been an increase in power demand in that section of the country of 9.5 per cent compounded yearly.

Mr. FULBRIGHT. Who is furnishing that power to meet this increased demand?

Mr. HILL. The power that supplies that section of the country now is the power that is developed by the big power companies and the municipal plants of cities.

Mr. SUMMERS. Mr. Hill, would you call attention to the Rock Island Dam which is under construction right now, near this same project?

Mr. HILL. Yes. The Rock Island Dam has just been completed. That was constructed by a Stone & Webster concern, and is called the Puget Sound Power & Light Co. That is one additional unit that has been added.

Mr. FULBRIGHT. Is the demand for power being amply taken care of at this time?

Mr. HILL. The demand is increasing.

Mr. FULBRIGHT. Of course, I understand it is increasing and will continue to increase, but is it being amply taken care of at this time?

Mr. HILL. If the power were cheaper, there would be a much greater demand for power. But power rates in our country, as well as in some other sections, are rather high and that in itself discourages people from using power. But the power demand is there, a present and a potential demand is there. There is no question in the minds of those who have surveyed the situation and are in a position to give the matter intelligent consideration that this power will be demanded and absorbed within 15 years' time and then will only supply half of the increased demand that will exist at that time.

Mr. FULBRIGHT. What appropriation do you contemplate the Federal Government will be called on to make in the future?

Mr. HILL. The total amount of appropriations that the Government will be called upon to supply will be $260,000,000 over a period of 50 years.

Mr. BUTLER. My recollection is that the figure $394,000,000 was mentioned.

Mr. HILL. That is the total cost, but the revenues from power will make the project a self-liquidating proposition after $260,000,000 has been advanced.

Mr. FULBRIGHT. But if it is not self-liquidating, then the Government is obligating itself for whatever part is not liquidated.

Mr. HILL. Of course, if it is not or if it does not become self-liquidating the Government would not get its money. But the obligation is upon the Secretary of the Interior to secure contracts which satisfy him will amply repay the money the Government has expended.

Mr. FULBRIGHT. If the project should prove a failure or not a money-making proposition it would mean that much of a loss to the Government?

Mr. HILL. Of course, if the project is a failure——

Mr. FULBRIGHT. Even if the project is not a success it would be a failure so far as the Federal Government is concerned.

Mr. HILL. Some of those projects are failures because of lack of a sufficient water supply, and I might revert here to the statements in this letter read by Mr. McFadden. Some of the projects he refers to have failed because there was a lack of water supply. You know you can not have irrigation without water, but in the Columbia River there is water for all the unreclaimed arid lands in the 11 Western States, if it were feasible to use it all.

Mr. BUTLER. If you will pardon me, Judge Hill, he made another erroneous statement there when he said that there was no flood-control problem on the Columbia River. There is a flood-control problem on the Columbia River, particularly with the raging streams which feed that river. There is serious flood-control problem there.

Mr. HILL. There is no question about that.

Mr. BUTLER. And that was taken into consideration by the Army engineers?

Mr. HILL. Yes.

Mr. ARENTZ. Mr. Hill, when you refer to these letters, you are referring to the letters produced by Mr. McFadden.

Mr. FULBRIGHT. As I understand it, Mr. McFadden did not make that statement himself, but he was quoting a statement made by somebody who wrote him a letter.

Mr. HILL. Nobody seems to know who this man is. I do not know him and I have lived in that country for nearly 30 years.

Mr. FULBRIGHT. He makes out a mighty strong case.

Mr. HILL. But he stands alone in it, that is the trouble, and he discredits everybody else who has passed on the project.

Mr. ARENTZ. Anyone who makes a statement that we should allow insect life to multiply and increase without let or hindrance, because, forsooth, it may decrease our surplus of food supplies, is starting out on an erroneous premise to which no one here can subscribe. That is utterly absurd.

Mr. SMITH. He made the statement before you came in that we should not interfere with nature, that nature has its own way of taking care of surpluses, and that we ought to permit the grasshoppers to come in and eat up the crops, to take care of those surpluses.

Mr. SUMMERS. Was that the author of the letter or was that the Congressman?

The CHAIRMAN. That was the Congressman.

Mr. ARENTZ. The same would apply to the boll weevil and the Mediterannean fruit fly——

Mr. SMITH. And the cattle tick.

Mr. ARENTZ. And the cattle tick and every other insect and pest of that kind. We all know that if we allowed insect life to increase without let or hindrance, they would replace man.

Mr. SMITH. Absolutely.

Mr. OVERTON. I think you are absolutely correct about that. That is the argument made in connection with flood control, that its purpose is to prevent devastation.

Mr. HILL. If we were to follow that theory, there would be no river and harbor improvements. River and harbor improvements are not reimbursable expenditures. This, however, is a reimbursable expenditure.

Mr. LOOFBOUROW. Will the field for the distribution of this power be in the cities of Spokane, Seattle, and Portland?

Mr. HILL. Yes; for a radius of 300 miles from the dam.

Mr. LOOFBOUROW. What will be the distance of the power plant from Spokane?

Mr. HILL. About 70 miles.

Mr. LOOFBOUROW. And what will be its distance from Seattle?

Mr. HILL. One hundred and sixty-five miles.

Mr. LOOFBOUROW. And from Portland?

Mr. HILL. Two hundred and twelve miles. Then it can reach back across the northern part of Idaho into Montana and south into Oregon.

Mr. LOOFBOUROW. What I want to bring out is that those three cities are within easy distance of the power plant.

Mr. HILL. Yes; and a number of smaller cities and a number of irrigation projects. Also a number of small communities that will be demanding power when they can get it at a price that will be attractive to them. This development will furnish that attractive price.

Mr. MARTIN. How much power is developed at Spokane, at the falls there?

Mr. GILL. Approximately 125,000, I think, on the Spokane River.

Mr. MARTIN. Can it develop any more?

Mr. GILL. That is practically its full development. There may be ten or fifteen thousand more, but that is practically its full development.

Mr. FULBRIGHT. What is the area of the land, if you know, to be submerged where this water is to be impounded by reason of the dam?

Mr. HILL. The dam will be 350 feet above the ordinary level of the stream and it will make a lake 150 miles long to the international boundary line. It will submerge, of course, lands along the river. The river runs in a gorge, the Columbia River runs in a gorge. Of course, there are benches along on the lower river.

Mr. FULBRIGHT. Will it submerge any lands that are now supposed to be farm lands?

Mr. HILL. No land that are profitably farmed. There are some lands cleared and developed that will be submerged, but they are not valuable lands.

Mr. FULBRIGHT. Are there any mineral lands involved?

Mr. HILL. No mineral lands that I know of.

Mr. FULBRIGHT. Oil lands?

Mr. HILL. I do not know of any.

Mr. FULBRIGHT. Who owns the major portion of that land to be submerged?

Mr. HILL. The Federal Government owns quite a bit of the land to be submerged. It is along the gorge of the Columbia River. There are some patented lands down there, too, but a good portion of it is public land belonging to the Government.

Mr. FULBRIGHT. Are any of these large corporations interested in or do they own any of that land?

Mr. HILL. No. That is not an attractive place for them. There are no values there that would attract them to the lands that would be submerged by the reservoir.

Mr. LOOFBOUROW. There are some small places along the river.

Mr. HILL. Just small places along the river; yes.

Mr. FULBRIGHT. It happens that I have had some experience with similar propositions and they did not look very good later on. It is a matter that I think we ought to know something about.

Mr. HILL. I want to say that this demand is not coming from the

reclaimed, in the area nearby, and from the cities of Seattle and Portland and Spokane and those communities. They, of course, would be interested in the development of that country.

Mr. FULBRIGHT. Has anybody tried to determine what it will cost to obtain the lands that will be submerged?

Mr. HILL. I have not that figure. I am told that that has all been considered in the Army report, but I do not know just what the figure is. It won't exceed probably $5 an acre.

Mr. MARTIN. I think you ought to bring out the fact that you are going to develop 1,200,000 acres.

Mr. HILL. There are 1,200,000 acres of land that will be actually developed, but less than 1,000,000 acres will be under water; that is, there will be that much in the area.

Mr. MARTIN. here will be that much covered by water?

Mr. HILL. Yes; but some of the land will be taken up with roads and canals, pasture land probably, and it will reduce the acreage actually reclaimed to something less than 1,000,000 acres. Now, that is spread out over a period of 60 years from about 1960 by bringing land in in small units. We expect the development to come, of course, in advance of that through this power and through the building up of industries and with the proceeds of that power we expect to help to defray the cost of reclaiming the land. From 1960 to 2000 there is not going to be any surplus of land in this country for farm uses and when that time comes, with this power development in advance, we will absorb the products of that reclamation project locally and if there should be any surplus produced, it will go to the Orient instead of going east, because of the heavy transportation charges by railroad. We can ship that stuff by boat from the seaports of the Pacific coast and put them in the Orient where there will be an increasing demand for it, and we will not be in competition with the mid-west farmers. We do not produce corn, we do not produce cotton, and we will not produce wheat on this reclaimed land, because the land will be too valuable, too high priced to produce wheat. There will be diversified farming, largely hay, dairying and truck crop production.

Gentlemen, that is a great desert right in the heart of our country. The progress of our country absolutely depends upon removing that desert or reclaiming the desert. We can not progress unless we have this development.

We are not trying to take the place in the sun of any other agricultural section. We simply want the opportunities in that Far West to develop our own country, that our own people may make progress as well as people in other sections of the country and we will pay back to the Government every cent of money that the Government advances for this purpose.

Mr. FULBRIGHT. Has private industry ever contemplated that kind of a development on the river?

Mr. HILL. No; because it is too large; it is just too big.

Mr. FULBRIGHT. It has been considered too large, or has it been considered unprofitable?

Mr. HILL. No. It has been considered too big an undertaking and you would have to have too much of an investment to start with. The returns would come in too slowly to justify the investment in it

by a private concern. We do have reclamation projects by private concerns, but they are smaller.

Mr. Chairman, if there are no further questions I would like to ask permission of the committee to have Mr. Gill say a few words at this time.

Mr. GILL. Mr. Chairman and gentlemen:

I have lived in Spokane 28 years and I never heard of this gentleman whose letters were introduced in the record. Of course, his statements were incorrect. In the first place, this project was not started by Spokane people. It was started by the United States Government, the engineers of the Reclamation Bureau in 1903, when a report was made by them stating that the project was believed to be feasible by pumping. Then for 15 years after that, the bureau's budget was absorbed by smaller projects and this project was not revived again until 1918.

Mr. HILL. How many years did you say?

Mr. GILL. Fifteen years, from 1903 to 1918, when Governor Lister of the State of Washington and Mayor Hansen of Seattle came to Spokane in 1918 and enlisted the aid of the business men in this project.

The Northwest has been back of this, the four States of Idaho, Montana, Oregon, and Washington.

I have resolutions from six of the County Pomona Granges on this project, which I would like to introduce in the record. I will not take the trouble of reading them.

There is a resolution of the Adams County Pomona Grange; the Douglas County Pomona Grange; the Franklin County Pomona Grange; the Spokane County Pomona Grange, and the Chelan County Grange; also the Washington State Grange in their annual session held at Bellingham, Wash., June 1 to 5, 1931, at which a resolution was passed which I will put in the record, and I will read that one resolution.

(The papers above referred to, including the resolution of the Washington State Grange, are as follows:)

Whereas this Pomona Grange having at a previous meeting passed a resolution to the effect that it was not in favor of indorsing the Columbia Basin project at that time on account of lack of knowledge of the same, does hereby wish to present this resolution in favor of the Columbia Basin project: Therefore, be it

Resolved, That the Adams County Pomona Grange, No. 52, does hereby indorse the Columbia Basin project.

E. A. GRAHAM.
WALLACE BECKLEY.
J. E. L. OLSON.
FRANK R. WEST.
By IVAN E. GRAHAM,
Reporter.

Resolved by Douglas County Pomona Grange in regular session this 12th day of December, 1931, That we indorse the Columbia Basin irrigation project, if by and through the Grand Coulee Dam, first the development of its potential hydroelectric power and the development of irrigation by such units as economic conditions may warrant; be it further

Resolved, That we contribute $10 for the promotion of this project; be it further

Resolved, That a copy of this resolution be sent to Senator C. C. Dill and Congressman Sam B. Hill.

RESOLUTION BY LINCOLN COUNTY POMONA GRANGE

Whereas the United States Army Engineers have completed a very extensive survey of the Columbia Basin irrigation project and are now conferring with the Reclamation Bureau engineers to iron out minor details in order to get their report ready to present to Congress at the next session; and

Whereas we are convinced that the project is going to be of great value and benefit to the whole Northwest, will relieve the labor problem in this locality in a marked degree, will aid the struggling farmers in the drought-striken area and we believe will change the climatic conditions in the Big Bend country by reason of the moisture in the air coming from the irrigated district; and

Whereas we are reliably informed that the sale of the power to be developed at the 350-foot Grand Coulee Dam will be sufficient to pay for all cost of the construction of the dam besides furnishing very cheap power to the whole community;

Now, therefore, we, the Lincoln County Pomona Grange No. 48, want to go on record as heartily favoring and indorsing the project and especially do we favor the method of the pumping plan at the Grand Coulee Dam to get the water for the Columbia Basin project, and that a copy be sent to each Pomona Grange in the State.

Adopted October 17, 1931.

JAMES MCKAY, *Secretary.*

Indorsed by the Franklin County Pomona Grange No. 51, on December 12, 1931.

GEO. K. DELANEY,
H. E. MCINTURF,
C. J. JONES,
Resolutions Committee.
FLORENCE MCINTURF, *Secretary.*

GRANGERS BACK BASIN IF MEAD'S COULEE DAM METHOD IS ADOPTED

SPOKANE, December 11.—The Columbia Basin project was indorsed by the East Spokane Grange Tuesday evening. Saturday the Spokane County Pomona Grange, which includes all local units in the county, will be asked to take similar action.

"The indorsement of the basin project was made with the qualification that the idea of building the project in units as has been suggested by Dr. Elwood Mead, Commissioner of Reclamation, be carried out," said A. A. Kelly, former State treasurer of the grange. "We want it understood that we are thoroughly in sympathy with the Columbia Basin project and are not opposed to any progress, but want to see the project developed in a practical manner.

"Doctor Mead's proposal would develop power on the Columbia River, utilize part of this power for pumping water to the plateaus in the Quincy district, selling the surplus power to surrounding towns and using the power revenue for paying for the development. The Quincy area has been suggested as the first unit because it would not directly compete with other developed areas in the State.

"There would be about 100,000 acres in the unit and sweet potatoes and grapes, not extensively grown elsewhere in the State, would be raised on much of the land."

[The Wenatchee Daily World, January 12, 1931]

CHELAN COUNTY GRANGE OUT FOR DEVELOPMENT OF BASIN BY BUILDING DAM AT COULEE—$3 LICENSE FEE FAVORED—NEW OFFICERS INSTALLED

The Chelan County Pomona Grange held its first meeting of the year Saturday afternoon and evening in the Masonic hall at Cashmere, and new officers of all the granges in the county were installed at a public meeting in the evening. This meeting was the best attended by new officers of any ever held in this district. Almost complete sets of officers were present from Manson, Chumstick, Peshastin, Cashmere, Beacon Hill, and Bee Hive Granges.

James O'Sullivan, of Ephrata, spoke upon the Coulee Dam and Columbia Basin project. Mr. O'Sullivan found a most interested and attentive audience and a very sympathetic response to his plea for help in their efforts to bring to fruition the plans they have worked so hard to get started.

A resolution was adopted to support the Coulee Dam and the irrigation of the Columbia Basin by the development of units as needed. Among other resolutions passed by the session was one favoring a $3 automobile license fee for private cars, a 50 per cent reduction on private trucks and a continuance of present rate on commercial trucks and busses, with a limit of 1 cent increase in gas taxes. Also a resolution favoring Federal control and operation of Muscle Shoals power project.

WASHINGTON STATE CHAMBER OF COMMERCE,
Seattle, Wash., March 4, 1932.

The following resolution was passed at the annual session of Washington State Grange, held at Bellingham, Wash., June 1–5, 1931.

This resolution is a part of the annual address of Mr. Albert S. Goss, master of Washington State Grange.

S. H. HEDGES, *President.*

"There is one sound basis upon which such projects as the Columbia Basin project could probably be developed. That basis would involve the construction of the dam at Grand Coulee for the purpose of developing power. As the power is sold and industries are developed through its consumption there will be a legitimate demand for more land. The gradual development of the irrigation features, largely paid for by the sale of power and developed only as the demand would justify, would constitute an economically sound development, and if such a project could be so safeguarded that the land would not be developed and thrown on the market except as the cost was largely absorbed, and a real demand established, the project would be sound and worthy of support.

"If the Columbia Dam project is carried out, provision should be made that power should be sold to all at equal rates, with public demands given the preference."

RESOLUTION ADOPTED BY DELEGATES AT THE WESTERN GOVERNORS' CONFERENCE IN PORTLAND, OREG., OCTOBER 29, 1931, RECOMMENDING CONTINUANCE OF FEDERAL RECLAMATION

Be it resolved, That Federal reclamation has been and is of great benefit to the entire Nation;

That its continuance is essential to the future growth and prosperity of the West and of the Nation as a whole.

I hereby certify that the foregoing is a true and correct copy of the resolution adopted by the western governors' conference at Portland, Oreg., October 29, 1931.

GEO. H. DERN,
Governor of Utah, Chairman Western Governors' Conference.
GEO. C. SUTHERLAND,
Secretary Western Governors' Conference.

[Congressional Record—Senate, January 8, 1932]

Mr. BROOKHART. I am very glad the Senator from Ohio asked that question, and now I want to answer it quite specifically. I want to call the attention of the Senator from New Mexico to my answer. The Senator from Virginia and the Senator from Ohio claim that aiding irrigation projects will increase the agricultural surplus and thus add to the difficulty which we are trying to obviate under the Federal Farm Board act. I have heard that argument and have met it many times. The Chicago Tribune particularly has hauled me over the coals regularly about once a month for that same inconsistency. So I had an analysis made—and I am going to ask the Senator from New Mexico when I shall have stated it if it does not set forth the facts—of all the irrigation projects in the United States. From that analysis I found that every one of

them developed a greater demand for agricultural products than it supplied Those projects develop cities and communities which would not have existed but for reclamation and yet, while in some cases the commodities produced might have more than supplied the immediate needs, on the whole, the projects themselves created a market for other agricultural products in my section of the country and in Ohio, which is the home of the Senator who has just interrupted me.

Mr. BRATTON. Mr. President, let me say that I agree with the Senator. The products of irrigation projects do not come in competition with the heavy commodities produced in other States, especially in the eastern part of the country, and there is no overproduction in that broad sense created by those sparsely located reclamation projects in the West. So that it is wholly incorrect to say that the encouragement of reclamation projects adds to overproduction throughout the country.

Mr. BROOKHART. I think in New Mexico, California, and Arizona and other sections where they have irrigation, including southern Texas, most of the products are different from those produced elsewhere or they are produced at a different time of the year than the crops produced in the Middle West, so that instead of being in competition with us they are supplementary to and of assistance to us.

I wish the farmers in my section of the country had sufficient income so that they could buy and use some of these winter products of the southern sections. I do not believe they do because they have not the income that would justify that sort of living at this time. So, Mr. President, in conclusion I will say that I hope the amendment of the Senator from New Mexico will prevail.

Mr. FULBRIGHT. They do not take the position that this is absolutely a practical project?

Mr. GILL. Yes; they state that.

Mr. FULBRIGHT. They state that it probably is.

Mr. GILL. If it is developed in the way suggested, they state——

Mr. FULBRIGHT. The portion that you read there does not indicate that they think it is a certainty by any means.

Mr. GILL. The opening statement is that there is one sound basis upon which a project as the Columbia Basin project could probably be developed.

Mr. FULBRIGHT. "Could probably be developed"?

Mr. GILL. Yes. The point I would like to stress is the fact that the development of these irrigation projects in the West furnishes large demands for eastern made products and thereby increases employment in eastern factories. In the two districts of Wenatchee and Yakima for the year 1930, the railroad shows a total inbound shipment of 69,351 carloads into these irrigated districts.

Mr. HILL. Mr. Chairman, Mr. James O'Sullivan has a few remarks to make, with the permission of the committee.

The CHAIRMAN. We shall be glad to hear him.

STATEMENT OF JAMES O'SULLIVAN, EXECUTIVE SECRETARY COLUMBIA RIVER DEVELOPMENT LEAGUE

Mr. O'SULLIVAN. Mr. Chairman and members of the committee, there was an inference in Mr. McFadden's statement that the people behind this project were dominated by speculative motives. I am executive secretary of the Columbia River Development League, which was organized in 1929. That league is supported entirely by the farmers and the town people living on this project and on areas surrounding the project. For many years those people have put up almost their last shirt in order to get some relief. The people on

this project—there are a lot of farmers on it, as you gentlemen know who have been on the project—have been suffering from drought since 1916 or 1917. They went in there in good faith to develop these lands. This is not a new reclamation project. This is a rehabilitation of lands that have already been farmed. This is a country with good roads, railways, farm homes, and towns. It is not a wilderness.

Mr. MARTIN. Let us understand that clearly. They have been farmed by dry farming?

Mr. O'SULLIVAN. Dry farming; yes. Precipitation has declined ever since 1917. In Douglas County, in this area, they had six banks in 1917 with $4,000,000 in deposits. To-day they have one bank with between $200,000 and $300,000 in deposits. Their assessed valuations have gone down. They are on the verge of ruin. A little irrigated area of 7,000 acres in that county, which has over 1,000,000 acres in dry-land farms, has been the sole salvation of the county since 1917.

The same thing is true of every other county in the project and in the surrounding areas. They have lost population at a tremendous rate.

The CHAIRMAN. Mr. O'Sullivan, as I understand you, this is not so much for the purpose of bringing in new land, but, as you say, is a rehabilitation project?

Mr. O'SULLIVAN. Yes; a rehabilitation of lands that have already been cultivated.

The CHAIRMAN. A great percentage of this land has been under cultivation?

Mr. O'SULLIVAN. Most of it. If you could see the helpless condition of those farmers who are still on it, I think tears would come to your eyes, as they did to Congressman Murphy's eyes when he was on the project last summer.

Mr. FULBRIGHT. What is the population; how many people live in this territory?

Mr. O'SULLIVAN. There are about 20,000 people living to-day in the area embraced by the Columbia Basin project. That area has been depopulating very fast.

Mr. HILL. That is, in the towns as well as on the farms?

Mr. O'SULLIVAN. Yes; I am speaking only of the population living on the lands embraced in the proposed project. There is a much larger population living on surrounding area that are also affected by the drought.

The CHAIRMAN. Could you give us the greatest population that you have had, approximately? You say the population is about 20,000 now?

Mr. O'SULLIVAN. We have had as high as 30,000 and 35,000 people on the proposed project lands. It must be remembered, however, that there are about 500,000 people living in eastern Washington who are more or less directly affected by the situation on the project lands and general drought conditions.

Let me say that there is not so much of a distinction or difference between the Mississippi case and this case as has been suggested. In the case of the Mississippi, you have a situation of a sudden devastation by nature. Here you have a devastation that is no less real covering a period of many years. It has been a slow process

of attrition that has undermined the stability of these farms, and not only these farms, but these towns, these cities, and these investments over a large territory.

The stability of the business structure of the whole State of Washington has been seriously impaired by drought conditions throughout all of eastern Washington since 1916 or 1917.

Letters from one Edwin Layton, of Kennewick, attacking the motives of Spokane in trying to bring about the rehabilitation of these lands have been read here. The people of that city have nobly assisted us in our plight. Their motives have been pure. They have sought the common good of the whole State, in fact of the Northwest. There can be no speculation whatever in the Columbia Basin lands. The prices will be fixed at actual value by the Government before it delivers water to any of the land.

The people of Kennewick do not agree with Mr. Layton. I have here a copy of a resolution favoring this project passed by the chamber of commerce of Kennewick. The original of this resolution was filed with the Board of Engineers for Rivers and Harbors at Washington, D. C., on February 3, 1932.

The resolution, dated September 10, 1931, reads as follows:

Whereas the farmers and townspeople on the Columbia Basin project in the State of Washington are facing dire want and the loss of millions of dollars through long-continued drought; and

Whereas the immediate authorization and construction of this project is absolutely necessary to relieve acute distress on the project and general unemployment throughout the Northwest; and

Whereas the authorization of this project by Congress will immediately restore confidence and prosperity in a large section of the West; and

Whereas the construction of the project will double, according to eminent authorities, the population of the Northwestern States and will be the impetus to a period of unexampled expansion and prosperity therein: Now, therefore, be it

Resolved by the Chamber of Commerce of Kennewick, Wash., That we do hereby pledge our full support to said project and urge upon the Federal Government the prompt authorization thereof.

THE KENNEWICK CHAMBER OF COMMERCE,
By LEE M. LAMPSON, *President.*
C. A. CARPENTER, *Secretary.*

Gentlemen, I have some other resolutions here favoring this project. I will not ask to have them all inserted in the record. These resolutions were passed by the chambers of commerce of Almira, Ellensburg, Wenatchee, Tonasket, Peshastin, Republic, Waterville, Odessa, and Chelan. Here are resolutions from the boards of county commissioners of Grant, Okanogan, Lincoln, and Douglas Counties. Here is a resolution favoring the project passed by the board of directors of the Quincy Valley irrigation district, which embraces about 400,000 acres in the project. Here is another resolution favoring the project from the Okanogan Power Users' Association. The farmers up in that county have to pump their water as high as 550 feet because their gravity supply gave out. They are large users of power and are much interested in the cheap power that will be available at the Grand Coulee Dam in the Columbia River.

Gentlemen, I will leave copies of these resolutions with you. Hundreds more could be secured if necessary. The sentiment in the State of Washington is practically unanimous for this development.

You can disregard reclamation entirely and still find complete justification for the construction of the Columbia River-Grand Coulee

Dam. Under the comprehensive plans recommended by Army engineers this dam is absolutely essential to the maximum development of the greatest power stream in America—the Columbia. That dam will constitute the dominating storage works on the whole river system, impounding over 5,000,000 acre-feet of water and thereby doubling the prime power at every dam downstream as far as the Snake River, and adding better than 50 per cent to the prime power at every dam in the river below the Snake.

The Army reports that this dam is the "key" dam, the great storage works on the river, and the Government is committed to the development of storage works.

In regard to the flood-control problem, Major Butler has asked me to insert in the record, as part of his testimony, this statement: That the development of these storage works on this river and on the other streams that are tributary to it, including the Snake, may have a material effect in reducing the flood problem on the lower river.

In 1894 there was a flood of 750,000 second-feet at Rock Island Rapids in the upper river. That flood covered a part of the city of Wenatchee, flooding out railways and even reached as high as the Great Northern depot in that city.

Now, gentlemen, a word about overproduction. I have been studying that for some time. We have been fed up on this propaganda of overproduction. According to Secretary Hyde's own statement in the Yearbook of Agriculture for 1931, there was then no real agricultural overproduction but a sharp price decline resulting from the present depression; and he says that if the depression had not occurred there would have been practically no surplus of agricultural production in the United States.

In 1929–30, according to Mr. Hyde's own statement as published in the Yearbook of Agriculture for 1931, the United States shipped in enough foodstuff from foreign lands—foodstuff that it could successfully raise itself—to justify the use of 10,000,000 acres of cultivated land in the United States.

The 11 Far Western States can not make any further progress without reclamation. That country is arid. These States, even to-day, are unable to raise enough staple feed crops and enough staple food crops to meet their own needs. They are not producing enough hogs, corn, oats, rye, milk, and butter to feed their own population. They are compelled to ship in vast quantities of hogs and considerable dairy products from the Middle West, a distance of about 2,000 miles, to the consuming centers along the Pacific coast.

If you stop reclamation in those States, you choke their growth and prosperity. You foredoom them to stagnation. You deny them the right to expand their basic industry. You commit a major crime against a great section of our country. In the past decade their population has increased 35 per cent as against 16.1 per cent for the Nation as a whole.

In the same period the population of California, Oregon, and Washington has increased 47 per cent, or nearly three times as fast as that of the United States.

The Army engineers, who had at their service the best population experts they could find, estimated that by 1960 the population of

Idaho, Oregon, and Washington will have increased by more than 1,400,000 people and that this increase in population would require more than the Columbia Basin project could produce in farm products.

Mr. FULBRIGHT. How do they arrive at a proposition of that kind; is that merely a conjecture on their part?

Mr. O'SULLIVAN. They based their estimates mainly on the prediction of our most noted population expert, who predicted our 1930 population (for the United States) within a few thousand people of what the 1930 census showed. They also considered the estimates of other experts and many other factors. They say that their estimate is very conservative.

Mr. FULBRIGHT. Upon what theory would they go there, for agricultural purposes?

Mr. O'SULLIVAN. People will go to the Northwest for many other reasons aside from agricultural opportunity. There are extensive commercial interests on Puget Sound. There are vast mineral resources in the Northwest awaiting cheap power for development. The development of cheap Grand Coulee power would be the means of building up population in advance of reclamation.

Mr. FULBRIGHT. It occurs to me that your power problem is the principal problem in connection with this matter. If they develop this power what would become of the interests now producing power and the people employed in that industry by those interests?

Mr. O'SULLIVAN. Let me explain that. Investigations conducted by the Army and the Reclamation Service show that the power market in that territory has been growing in the last 25 years at the rate of 9½ per cent compounded annually. On the basis of the past rate of growth, they have extended the estimates into the future, but they have cut down the rate of growth. The Army starts with a rate of growth of 9½ per cent in 1930, but cut it down to a rate of but 4.75 per cent in 1960. The estimates of the Reclamation Service are even more conservative.

After a most exhaustive investigation of the power market the Army and Reclamation Service experts state that only one-half of the additional power requirements of the Northwest would have to be supplied by Grand Coulee power and that this power could be absorbed in 15 years after the dam is completed. The balance of the increased requirements of the Northwest have been left to existing electric utilities to supply. The Grand Coulee development would not interfere with existing developments or their normal expansion in the future.

In regard to the Northwest power market, let me say that we will be just starting out there in development if the project is built. We have vast possibilities for the use of cheap power in pumping. The Grand Coulee project alone will require 660,000 horsepower. In California they are now using 872,000 electric horsepower for pumping for irrigation. We are using to-day in the State of Washington but 33,000 horsepower for such purposes.

Mr. FULBRIGHT. Is it not a fact that power consumption is being reduced practically all over the country, in every section of the country with the exception of a few minor instances?

Mr. O'SULLIVAN. Yes; the industrial load has dropped somewhat as a result of the depression. The domestic load has increased. The

electric utilities are making more money than they made before the depression. But as soon as the depression ends the industrial load will pick up again.

Mr. FULBRIGHT. Has this estimate been based upon the period previous to 1921 and 1922, when we were at the peak of activity?

Mr. O'SULLIVAN. No; the estimate was based on the period prior to 1930.

Mr. FULBRIGHT. It has been continually reducing since 1920, has it not?

Mr. O'SULLIVAN. No; our use of power in the Northwest has increased at the rate of 9½ per cent compounded annually since 1921. We are the largest users of electric power per capita of any section of the United States. We have just commenced to use electric power. We have barely scratched the market for electric heating, electric cooking, electric refrigeration, and electric pumping. The Army report shows that the increase is mainly in the domestic use. It shows great possibilities of expansion in the domestic field alone.

The power-market estimates made by the Army and Reclamation Service are made in the same manner as those made by the private electric utilities. The power companies use the same kind of estimates, made in the same manner, in order to determine whether they shall make an investment in a power project. The sworn testimony of the heads of the electric utilities in the Northwest makes the same predictions as to the future power market in that area at least up until 1940, the extent of their predictions, as those made by the Army and Reclamation Service experts.

Mr. SMITH. Were you here, Mr. Fulbright, when the Army engineers were here?

Mr. FULBRIGHT. No; I was not here then.

Mr. SMITH. The Army engineers stated that the power companies in the Northwest had cooperated with them in all their investigations on the theory that it was more economical and more advantageous to them to buy the power when it was generated than it was to expend money on new plants, so the people employed in the existing power plants would not be injured or disturbed.

Mr. FULBRIGHT. In other words, it is contemplated that this power shall be sold to the power interests and not directly to the people?

Mr. SMITH. The power companies would distribute it like they do at other places.

Mr. O'SULLIVAN. Going back to the question concerning the drop in the power load during this depression, let me say that if you will look at the power growth curves in the Army report, which cover the period between 1905 and 1930, you will find that the temporary loss in load during every depression has been more than made up by the jump in the load when the depression ends.

Mr. FULBRIGHT. I understood you to say it had increased something like 9 per cent since 1930?

Mr. O'SULLIVAN. Since 1920. I just want to make this comment, also: The farmers out there in that State need this cheap power. A lot of them are now pumping.

Mr. FULBRIGHT. Are they going to get this power direct from this company, or are they going to get this through the power companies?

Mr. O'SULLIVAN. Under the terms of this bill, they will have a right to buy this power at the dam before any is allotted to the private utilities.

Mr. SMITH. Answering the question further, it is not contemplated that the Government will distribute the power to the individuals, because that would be very expensive. But they would sell the power to distributing companies there, those now existing.

Mr. FULBRIGHT. They would sell it to municipalities direct?

Mr. O'SULLIVAN. The Government would sell it to municipalities, to power and irrigation districts and to the private utilities, in other words, to any one that would buy it. That is provided in the bill.

It must be remembered that the farmers of the Northwest need cheap power. Many of them in eastern Washington have to pump water for irrigation and they are paying as high as $6.25 per horsepower each month for power, or more than $35 per horsepower for the irrigation season. This secondary or flood water power can be generated at the Grand Coulee at a cost of less than half a mill per kilowatt-hour or about $3.75 per horsepower per irrigation season. As stated by Major Butler and Colonel Cooper, Grand Coulee power will be the cheapest, for it's bulk, in America.

Mr. CHAVEZ. How cheap will it be after it gets into the private utilities' hands?

Mr. O'SULLIVAN. I do not know. That depends upon the board of public works. Of course, the municipalities have the right to get that power, as do the power disttricts and the irrigation districts.

Mr. FULBRIGHT. In getting it, do they compete with the private utilities?

Mr. O'SULLIVAN. They have to build their lines up to the dam to get the power. In some cases they might compete with the private companies.

Mr. CHAVEZ. Are they in a position to do that?

Mr. O'SULLIVAN. I think so.

Mr. ARENTZ. The same thing will be done there as is contemplated to be done in carrying the power from Boulder Canyon to Los Angeles. That is distributed through contracts entered into between the municipalities and the power companies, and there will be one line, and they will all join in and share in the cost of that line and pay their pro rata share of the cost and upkeep per year.

So that if the small municipality or irrigation district or farming unit want to join in, they will put in their bid and pay their share of the carrying charges of the transmission line, because the power companies will be just as happy over the idea of having part of that load carried by the individual users of the power as the individual users will be to avail themselves of that privilege.

Mr. O'SULLIVAN. I want to add a few words about Federal Reclamation. It is not subsidized as Mr. McFadden infers. The revolving fund devoted to Federal reclamation in equity belongs to the Western States. This fund consists mainly of receipts from the sale of public lands in 16 Western States, of receipts from oil and potassium leases or royalties in all of said States except Kansas, Nebraska, Oklahoma, and Oregon and from oil leases in Alabama and Louisiana. On June 30, 1931, this fund was as follows:

Accretions to reclamation fund		$151,694,084.72
Advances to reclamation fund:		
Bond loan	$20,000,000.00	
Less amount paid	10,000,000.00	
Total	10,000,000.00	
Treasury loan (act Mar. 4, 1931)	2,000,000.00	
		12,000,000.00
Total		163,694,084.72

Congress, in establishing our western reclamation policy, had a good precedent for considering these funds as equitably belonging to the Western States. In 1836 it distributed to the Eastern States, then in the Union, $28,000,000 that had accrued from the sale of public lands, not a dollar of which, either in principal or interest, has ever been repaid. The Western States through the National Government are using funds derived from their own natural resources in an effort to reclaim their vast arid territory.

Federal reclamation is an outstanding national success. It is one of the very few activities of the Federal Government that is conducted on a business basis and that is returning every dollar invested in it. On June 30, 1931, the situation was as follows:

Contracts for repayments		$197,265,784.17
Capital invested	$163,694,084.72	
Charge-offs, etc	16,855,932.58	
		180,550,017.30
Balance		16,715,766.87

On that date, exclusive of the charge-offs, etc., about 97 per cent of the total payments due from the settlers had been met.

In striking contrast to this, we find that nearly all the other appropriations by the Federal Government are nonreimbursable. We have probably appropriated $2,000,000,000 for river and harbor improvement without any direct return of principal or interest. For the last several years the Department of Agriculture has spent, purely for agricultural purposes, more than $100,000,000 a year, mainly to subsidize agriculture in the East. The cost of running the Farm Board, in a recent year, was $102,000,000 and the loss incurred by this board trying to stabilize the price of wheat and cotton amounted to close to $200,000,000. Not a dollar of these huge subsidies will ever be returned. The nonreimbursable expenditures of the Department of Agriculture for but two years greatly exceeds the total sum invested in the Federal reclamation fund covering operations lasting over 30 years. We have subsidized our shipping interests to the extent of many millions of dollars. The sum invested in Federal reclamation, that is reimbursable, is a mere bagatelle compared to the enormous sums given other interests, all of which are plain, outright gifts, and makes one wonder if the attacks on Federal reclamation are sincere.

The CHAIRMAN. Mr. Summers, have you an additional statement you desire to make?

Mr. O'SULLIVAN. Under the terms of this bill, they will have a right to buy this power at the dam before any is allotted to the private utilities.

Mr. SMITH. Answering the question further, it is not contemplated that the Government will distribute the power to the individuals, because that would be very expensive. But they would sell the power to distributing companies there, those now existing.

Mr. FULBRIGHT. They would sell it to municipalities direct?

Mr. O'SULLIVAN. The Government would sell it to municipalities, to power and irrigation districts and to the private utilities, in other words, to any one that would buy it. That is provided in the bill.

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The CHAIRMAN. Mr. Summers, have you an additional statement you desire to make?

STATEMENT OF HON. JOHN W. SUMMERS, A REPRESENTATIVE FROM WASHINGTON—Continued

Mr. SUMMERS. Mr. Chairman, the question has turned very much on the power, and I think that is very proper, because that is the only thing that is contemplated for many years.

Mr. Fulbright did not have the opportunity of being present when some of the testimony was given, and I think it is only fair to call his attention to this fact, that Tacoma, a city of something more than 100,000 population, has but recently completed a new hydroelectric power plant. Seattle has but recently completed a very extensive municipal hydroelectric power plant, in addition to what they already had.

Seattle is supplied, as I understand it, partly by municipal power and partly by private power.

A private power company has built on the Columbia River [illegible] so many miles from the point we are talking about, a dam and installed a plant at an expense of something like fifteen or twenty million dollars to carry additional power over there to help them supply the city of Seattle.

Mr. SMITH. What is the name of that company? Is it the Rock Island Co.?

Mr. SUMMERS. It is called the Rock Island Dam. It is near Wanatchee, in the Columbia River.

Mr. FULBRIGHT. That would be absorbed in this project, would it not?

Mr. SUMMERS. No; that is wholly independent of this project. That is ready to operate at this time.

Mr. GILL. It has not commenced to distribute any power yet.

Mr. SUMMERS. It is practically completed at this time. The first unit is in operation.

The Great Northern Railroad has developed a power plant at the lower end of Lake Chelan. The Milwaukee Railroad, as you may know, is electrified from a point near Harlow, in Montana, all the way through until you get beyond Spokane. Then there is a little gap, and then it is electrified again on across the mountains to Seattle and Tacoma, and we have three or four of these transcontinental railroad lines.

I mention these things, Mr. Fulbright, so you may see just how our use of power has been growing. It takes many years for a big plant like this to be constructed, and that is why we are talking to you seriously here this morning.

It is not that we expect reclamation or power right away. Doctor Mead told us it would take from three to five years to prepare blue prints, to make preliminary contracts with power companies that would guarantee the Interior Department the repayment of all the expenses at 4 per cent interest. Then we asked Major Butler, of the Army engineers, who spent about three years out there in making surveys, about how rapidly they would call on us for money, after the first three or five years, providing the Treasury was in good condition.

After that preliminary period of 3 or 5 years assuming that the country has come back, then Major Butler said there would be re-

quired in the first year $7,500,000, and the next year the same amount, and the next year the same amount, and in the fourth year of their construction the largest sum would be required that they would require in any one year, when they would call for $31,000,000, but not earlier than 7 or 8 years from now.

Mr. FULBRIGHT. They would require $7,500,000 in the first year.

Mr. SUMMERS. That is, after the first five years. Then for the first year, the second year, and the third year they would require $7,500,000 each year, and they calculate it will take 10 years to build the dam and construct the power plant.

They calculate from three to five years, including the signing up of the contracts, that no money shall be appropriated.

So I think, with this little review of what is being done in the way of developing the many power plants and the very considerable plants that I have referred to, will help us to understand the matter, along with the statement as to the increased population in the States that are within reach of this power. Mr. O'Sullivan gave the figures, as compared with the average increase in the United States. It is very much greater.

That increase is because it is a new country. We think it is a very desirable country for people to live in.

At any rate, it has been demonstrated that factories of all kinds do exceedingly well, as far as production is concerned. That was demonstrated during the war by the building of ships out there, and it was demonstrated in the last two or three years, when our navy yard, which is adjacent to Seattle, built one of our United States cruisers for about $2,000,000 below the estimated cost and in a considerably shorter time than was estimated. With the Orient beyond us, we are looking in that direction. And we do have to have some of these preliminaries out of the way. We can not talk to any man in the United States with a contract before him about signing up for power until we know finally that the plant will be built, when the Treasury justifies it, and the power is all signed up. So that is why we have to plan so long in advance.

Mr. OVERTON. What would be the period of time for those contracts? What period of time do they cover?

Mr. SUMMERS. Fifty years.

Mr. OVERTON. The companies would sign to take power for a period of 50 years?

Mr. SUMMERS. Yes. That reminds me of one thing that is very vital. By an initiative law in our State it became possible for any county or group of counties, or district to organize as a power company. So if these agencies that are to take the power from the switchboard do not supply power at a reasonable price, then there is nothing to hinder the people themselves from organizing and taking the power directly from the switchboard and handling it at cost. That is now our State law.

GRANGE ATTITUDE

In the Grange News of June 20, 1931, appears a letter from Mr. A. S. Goss, Master, Washington State Grange, from which I quote:

> We feel that if the Columbia Basin project were developed first by building a dam at Grand Coulee and selling power, and, secondly by developing the

land as fast, and no faster, than the demand for food and fibres would warrant, it would be a sound method of approaching this problem, because the demand for power would undoubtedly result in a building of industry which would furnish a market for a gradually expanding agriculture. Any other type of development the grange will continue to oppose as untimely, and it should be clearly understood that the development of the power is the key to the development of irrigation under the plan recently approved by the Washington State Grange.

The total net acreage to be irrigated by the year 2000 is 902,500 acres. Prior to 1950 or 1955 the engineers state that we must consider the Grand Coulee power project where more power and cheaper power can be developed than at any other place on this continent.

Mr. HILL. Mr. Chairman, I think that is all we have. We thank you very much for your courtesy in listening to us, and we will submit the case to you.

The CHAIRMAN. This will conclude the hearing.

(Thereupon, the committee proceeded to the consideration of executive business, after which it adjourned, subject to the call of the chairman.)

(Subsequent to the close of this hearing the following letter was received from Mr. Edward F. McGrady, legislative representative of the American Federation of Labor, which is here printed in full as follows:)

AMERICAN FEDERATION OF LABOR,
Washington, D. C., June 14, 1932.

Hon. ROBERT S. HALL,
House Office Building, Washington, D. C.

MY DEAR CONGRESSMAN: At the request of Roy R. Gill, chairman of the executive committee of the Columbia Basin Irrigation League, I am herewith submitting a statement from the American Federation of Labor favoring the Columbia Basin project.

Very truly yours,

EDW. F. MCGRADY,
Legislative Representative American Federation of Labor

STATEMENT BY EDWARD F. MCGRADY

JUNE 14, 1932.

The American Federation of Labor in 1928 appeared in favor of the development of the Columbia Basin. The reasons that we presented at that time are equally applicable to-day. In fact, as far as developing this project in the interest of creating work is concerned, the need is greater than ever. With 10,000,000 of our people without any work at all and millions more in poverty, it is our belief that the Federal Government should provide generous appropriations for a public-works program, and I know of no better program than to start work at once on a large scale on the development of the Columbia Basin.

This is one of those projects that the President of the United States favors, namely, a self-liquidating project. The Federal moneys appropriated for this project will be returned to the Treasury.

The development of the Columbia Basin should be undertaken at once, not only as I have said, to provide work for our citizens, but because there is an actual necessity for it.

One of the reasons why suffering has become so acute in the past three years in the large industrial centers is because of the migration to these centers of several hundred thousands of farmers. These farmers and everyone else who has studied the subject, know that this migration was a mistake and serious efforts are now being made to get these agriculturists back on the farms where they belong, and where they can live much better than they can in the slums of the cities.

The lands which are to be irrigated under the Columbia Basin project are of the type and character that will quickly attract dwellers who are desirous of obtaining small farms and on which diversified agricultural products can be grown.

The Columbia Basin area is adapted to raising apples, pears, prunes, cherries, peaches, cantaloupes, asparagus, watermelons, and the hardier vegetables. It is also adapted for the raising of alfalfa, corn, wheat, barley, oats, seeds, potatoes, and sugar beets.

The Columbia River Basin project when complete would be helpful to the whole Northwest, especially the States of Washington, Montana, Oregon, and Idaho. The products of these lands will find a ready market in the cities of Portland, Tacoma, Spokane, Seattle, and other rapidly developing communities. These products will also find markets in the Philippine Islands, Hawaii, and even in Japan and China.

President Hoover, when Secretary of Commerce, made a careful inspection of this project accompanied by members of the reviewing board of engineers and farm economists. He said on August 22, 1926, "I have familiarized myself with the engineering problems involved and the time to begin this great undertaking is now." President Hoover further said that he saw no reason why the Government should not undertake the financing of the Columbia Basin project.

The American Federation of Labor agrees with both of the foregoing statements. This project is badly needed and there has been no project proposed that would bring greater return on the money invested. There is no undertaking that could put men to work quicker than the Columbia River Basin, if an adequate appropriation is made at once.

We hope the bill will pass.