62D CONGRESS, 2d Session. } HOUSE OF REPRESENTATIVES. { DOCUMENT No. 693.

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Office Chief of Engineers

COLUMBIA RIVER, MOUTH OF SNAKE RIVER TO WENATCHEE, WASH.

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING,

WITH A LETTER FROM THE CHIEF OF ENGINEERS, REPORTS ON EXAMINATION AND SURVEY OF COLUMBIA RIVER, WASH., FROM THE MOUTH OF SNAKE RIVER TO WENATCHEE.

APRIL 11, 1912.—Referred to the Committee on Rivers and Harbors and ordered to be printed.

WAR DEPARTMENT,
Washington, April 10, 1912.

SIR: I have the honor to transmit herewith a letter from the Chief of Engineers, United States Army, dated 9th instant, together with copies of reports from Maj. C. W. Kutz, Corps of Engineers, dated June 9, 1909, and July 11, 1911, on preliminary examination and survey, respectively, of Columbia River, from the mouth of Snake River to Wenatchee, Wash., made by him in compliance with the provisions of the river and harbor act approved March 3, 1909.

Very respectfully,

H. L. STIMSON,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, April 9, 1912.

SIR: I have the honor to submit herewith for transmission to Congress reports dated June 9, 1909, and July 11, 1911, by Maj. C. W. Kutz, Corps of Engineers, on preliminary examination and survey, respectively, of Columbia River, from the mouth of Snake River to Wenatchee, Wash., authorized by the river and harbor act approved March 3, 1909.

This stretch of river is about 147 miles long. It is now navigable at all stages, except when closed by ice, for boats drawing from 3 to 4 feet for about 130 of the 147 miles. When the river is from 12 to 15 feet above low-water stage continuous navigation is possible, though difficult and hazardous in places, from the mouth of the Snake to Wenatchee. The principal obstacles are Rock Island, Cabinet and Priest Rapids, where some open-channel work was done by the United States between 1890 and 1895. The physical conditions, however, are such that a navigable low-water channel can not be maintained by open-channel methods, and canalization will be required to overcome Rock Island and Priest Rapids.

It being evident that the cost of canalization would not be justified solely in the interest of navigation, the district officer gave consideration to the coordination of navigation improvement and water-power development with a view to the possible reduction of the expenditures directly in the interest of navigation to an amount which would be justified by the resulting benefits to commerce.

He presents several plans for improvement, all of which are fully discussed in his report, but the one preferred by him as the most favorable for combined development contemplates the following work: The construction of a single lock at Rock Island Rapids at an estimated cost of $1,410,000, exclusive of power house and machinery, or with the cost of the excluded items ($500,000), a total for coordinate development of $1,910,000; the construction of three locks to surmount Priest Rapids at an estimated cost of $3,400,000, exclusive of power house and machinery, or, with the cost of the excluded items ($1,650,000), a total for coordinate development of $5,050,000; and the removal of bowlders to clear the channel and other necessary open-channel work, $65,000, or a total for coordinate development in the entire stretch of $7,025,000.

The total actual cost of improvement for navigation is $1,925,000 on the assumption that the balance of the cost of the project would be chargeable to the power developed, which, of course, can not be assured. The actual expenditure required to carry out this project, however, including power development, would exceed this amount by $5,100,000, thus making a total expenditure of $7,025,000 necessary for coordinate development, as stated above. On the basis of the United States creating navigation by carrying out the project suggested, exclusive of the power development, the cost over this reach would be $4,875,000. The cost of maintenance of the locks is estimated at $50,000 per annum.

The district officer is of opinion that the amount of traffic in prospect is not sufficient to warrant the expenditure of $7,025,000 even if $5,100,000 of this amount may be considered as income producing, and therefore he reports that the improvement is not worthy of being undertaken by the United States at this time. The division engineer concurs in this view.

These reports have been referred, as required by law, to the Board of Engineers for Rivers and Harbors, and attention is invited to its report herewith, dated January 9, 1912. The board has held a public hearing on this subject in this city, to which interested parties were invited, and after a careful review of all the information presented, including a number of communications received, concurs in the opinion expressed by the district officer and the division engineer.

After due consideration of the above-mentioned reports, I concur in general with the views of the district officer, the division engineer, and the Board of Engineers for Rivers and Harbors, and therefore, in carrying out the instructions of Congress, I report that the improvement by the United States of Columbia River, from the mouth of the Snake River to Wenatchee, Wash., in the manner apparently desired by the interests concerned, as described in the reports herewith, is not deemed advisable at the present time.

Very respectfully,

W. H. Bixby,
Chief of Engineers, U. S. Army.

The Secretary of War.

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS ON SURVEY.

[Third indorsement.]

The Board of Engineers for Rivers and Harbors,
Washington, January 9, 1912.

Respectfully returned to the Chief of Engineers, United States Army.

The results of the survey of Columbia River from the mouth of the Snake to Wenatchee show that this reach is susceptible of improvement by the removal of bowlders so as to secure fairly good 6-foot navigation at moderate cost, except at Rock Island Rapids and at Priest Rapids. These are serious obstructions and can only be satisfactorily improved for useful navigation by canalization.

At Rock Island Rapids there is a drop of about 12 feet at low water. A large island divides the river into two channels. It is proposed to surmount this reach by means of a lock and dam in the left channel, which will make practicable a water-power development of about 8,000 to 12,000 horsepower. The estimated cost of this improvement, exclusive of power house and machinery, is $1,410,000, the approximate estimate of the power plant being $500,000, making a total of $1,910,000. There is practically no market for power in the immediate vicinity of these rapids, but the district officer believes that with the increasing development of the country adjacent there would eventually be a demand for the full amount, at least during the irrigation season. Assuming that all power is sold at the rate of $15 per horsepower, and capitalizing the income at 10 per cent to cover all expenses of operation, repairs, depreciation, and shortage in demand for power, gives an investment of $1,200,000 and makes the net cost for navigation $710,000.

Priest Rapids. This stretch extends over a distance of about 9¾ miles, having a total fall of 68 feet at low water. There are seven rapids. A part of the power of this reach has been developed by a private company, now the Washington Irrigation & Development Co., by means of a canal on the right bank of the river, at the head of which a small crib dam was thrown across one of the river channels. This plant develops a power of 1,200 to 2,500 horsepower.

Four plans for the improvement of Priest Rapids are discussed by the district officer. These are designated by the latters N, P, H, and L, and plan L is selected by the district officer as the most favorable

one for combined development of navigation and water power. It contemplates the construction of a longitudinal dam in the river founded on three islands with a flight of two locks at the lower end which will overcome the fall of the lower three rapids, utilizing the open river through the fourth and fifth rapids and building a single lock to overcome the sixth and seventh rapids. *This plan will permit the development of 18,000 horsepower at the lower lock with 12,000 additional horsepower during the irrigation season. The estimated cost of this project, exclusive of power house, machinery, etc., is $3,400,000, the excluded items amounting to $1,650,000, making a total of $5,050,000.* This plan represents an investment of $3,900,000 for power development and $1,150,000 for navigation purposes. The L project is the only one which could be executed without acquiring a right of way, but even in this project some doubt appears to exist as to the ownership of the islands to be occupied.

The Washington Irrigation & Development Co. has plans for the enlargement of its plant to a capacity of 30,000 horsepower, but permission to carry out these plans has been at least temporarily refused by the War Department. It is stated that the ultimate aim of the company is to develop the entire power of Priest Rapids by a high dam across the river, drowning out all the rapids, and to construct a flight of locks without cost to the United States and provide the necessary power for operating them.

The total cost of the improvement of the Columbia River between Snake River and Wenatchee in the interests of navigation may be summarized as follows on the basis of using plan L:

Above Rock Island Rapids, removal of bowlders	$25,000
Rock Island Rapids	710,000
Cabinet Rapids, removal of bowlders	25,000
Cabinet Rapids to Priest Rapids, removal of bowlders	15,000
Priest Rapids, L project	1,150,000
Total	1,925,000

The actual expenditure required to carry out this project, including power development, would exceed this amount by $5,100,000, making a total of $7,025,000. While, as figured above, the navigation cost would be $1,925,000, this is on the assumption that the balance of the cost of the project would be chargeable to the power developed, which, of course, can not be assured. On the basis of the United States creating navigation by carrying out the project suggested, exclusive of the power development, the cost over this reach would be $4,875,000. The cost of operation and maintenance of the locks is estimated at $50,000.

The commerce reported between Priest Rapids and the mouth of the Snake for 1908 is 11,712 tons; that for the Columbia between Wenatchee and Bridgeport 54,000 tons, and the district officer states in his report on preliminary examination that even if all this tonnage was carried to and from Portland by river it would not be sufficient in itself to warrant the probable cost of the work. It appears from the within report that there has been a decrease in the tonnage below Priest Rapids to 10,035 tons and a decrease in the section above Wenatchee to 23,722 tons, the latter reduction being accounted for by the district officer from the fact of the building of the Waterville branch of the Great Northern Railway, which now carries the greater part of the wheat formerly shipped to Wenatchee by boat. With reference to the use of the river as a through transportation route the district officer states that if the river were made navigable to Portland some freight would be shipped by that route, but that the amount would probably be small, as it would mean a 380-mile haul by water as compared with a 165-mile rail haul. The district officer concludes that the amount of traffic in prospect is not sufficient to warrant the expenditure of $7,025,000 even if $5,100,000 of this amount may be considered as income producing, and he therefore concludes that the improvement is not at this time worthy of being undertaken by the United States. The division engineer concurs in this view.

The board has given careful consideration to this subject, has reviewed a number of communications received, and on December 11, 1911, gave a public hearing, at which Hon. George E. Chamberlain, Hon. W. L. Jones, Hon. Miles Poindexter, United States Senators; Hon. William A. La Follette, Hon. William E. Humphrey, Members of Congress; Mr. J. N. Teal, and Capt. Fred McDermott appeared in advocacy of the improvement. Much interest has been displayed in this subject since the announcement of the district officer's unfavorable report. Interested parties apparently realize the advantages of through water transportation, both in relieving possible congestion in traffic and its effect as a regulator of rates.

The board fully appreciates these benefits and advantages. It believes, however, that the section to be benefited has not developed sufficiently to produce a commerce commensurate with the cost of the work involved. Allowing 3 per cent of the actual cost of the work necessary to create navigation alone, not taking into account returns from water power, which under existing conditions can not be assured, and adding the annual charge for maintenance, we have an annual outlay of $196,250. It is obvious that the present commerce on this river would have to be multiplied many times in order to justify the expenditure required. While this section of country is rapidly developing, it does not seem to the board that there will be sufficient commerce in the near future to warrant the large expenditures now contemplated, and therefore the board concurs with the district officer and the division engineer in the opinion that it is not advisable for the United States at this time to undertake the improvement of Columbia River from the mouth of Snake River to Wenatchee.

For the board:

WM. T. ROSSELL,
Colonel, Corps of Engineers,
Senior Member of the Board.

PRELIMINARY EXAMINATION OF COLUMBIA RIVER FROM THE MOUTH OF SNAKE RIVER TO WENATCHEE, WASH.

UNITED STATES ENGINEER OFFICE,
Seattle, Wash., June 9, 1909.

SIR: In compliance with instructions contained in letter of March 8, 1909, I have the honor to submit the following report upon preliminary examination of the Columbia River from the mouth of Snake River to Wenatchee, authorized by the act of Congress approved March 3, 1909.

This stretch of the river is about 147 miles long, and is shown on the accompanying map[1] compiled from the records of the office. It is crossed by three transcontinental railway lines. The Northern Pacific crosses a few miles above the mouth of the Snake; the Chicago Milwaukee & Puget Sound crosses at Beverly, about 90 miles above the mouth of the Snake; and the Great Northern crosses at a point 139 miles above the mouth of the Snake, or 8 miles below Wenatchee. About 130 miles out of the 147 is now navigable at all stages of the river, except when closed by ice, for river boats drawing from 3 to 4 feet of water. When the river is from 12 to 15 feet above low-water stage continuous navigation from the mouth of the Snake to Wenatchee is possible.

There are three main barriers to continuous low-water navigation—Rock Island Rapids, Cabinet Rapids, and Priest Rapids. The first two are only 6 miles apart, and considering them as one obstruction the river is naturally divided into three parts. The first of these extends from Wenatchee to the head of Rock Island Rapids, about 12 miles, and is now in fairly good condition, though obstructed by a number of rapids over which upstream navigation would be difficult at times of low water, and also by a number of bowlders at different points which would render low-water navigation more or less hazardous. This stretch, however, will admit of improvement at relatively small cost. It was surveyed in 1894, and a report thereon, with map, published in the Annual Report of the Chief of Engineers for 1895, page 3534.

Between the lower end of Cabinet Rapids and the head of Priest Rapids (about 42 miles) the river is said to be in good condition, with relatively small slope and depth sufficient for ordinary Columbia River boats at all stages of the river. It was used recently for hauling material required in the construction of the Chicago, Milwaukee & Puget Sound Railway bridge, material being brought by barges and river steamer from Vulcan, on the line of the Great Northern Railway. There is ordinarily no traffic on this stretch of the river, at least not sufficient to support a steamboat, and upon completion of the bridge the steamer used by the railroad company was taken to Wenatchee.

From the lower end of Priest Rapids to the mouth of the Snake the river is in good navigable condition except for some shoals of a minor character in the vicinity of White Bluffs, where the bed of the river is considerably wider than at points above and below. This obstruction, however, is not serious and the difficulty can probably be remedied at slight cost by the construction of a few wing dams. One and occasionally two steamers operate on this stretch of the river, making regular trips every other day to Hanford and White Bluffs, with biweekly trips to the foot of Priest Rapids. The waterborne commerce between Priest Rapids and the mouth of the Snake for 1908 is reported by the steamboat company as 11,712 tons. Practically all of it is upstream traffic, the recent agricultural development in the vicinity of Hanford and White Bluffs not having advanced far enough to afford any downstream tonnage.

The three main barriers above referred to (Rock Island Rapids, Cabinet Rapids, and Priest Rapids) were surveyed a number of years ago with a view to open-river improvement, but no continuous survey of the Columbia River from the head of Rock Island Rapids to the mouth of the Snake River has ever been authorized. These detached

[1] Not printed.

surveys showed that Rock Island Rapids had a fall of 12½ feet in 8,000, and Cabinet Rapids a fall of 10 feet in 8,000, both at a stage of about 4 feet above low water, while Priest Rapids was shown to have a total fall of 72 feet at low water in a distance of 10 miles, the most of it being concentrated in seven rapids. The act of September 19, 1890, contained an item of $70,000 for the improvement of these rapids, and of this sum about $50,000 was expended in the removal of rocks and bowlders. As a result of this work the conditions at Cabinet Rapids were bettered, but the work at Priest Rapids and Rock Island Rapids was not sufficient to produce any noticeable improvement. Results obtained were so unsatisfactory that the district officer in his report of 1895 on the improvement of the Columbia River from the head of Rock Island Rapids to the foot of Priest Rapids stated:

> As the improvement of this river by any system of regularization to give practical navigation appears to be chimerical, and as there is no navigation of the river, no further appropriation is suggested for the work.

A personal examination of the river from Wenatchee to Kennewick was made on May 9 to 12, on which dates the gauge at Wenatchee showed a stage of about 12 feet. Interviews were had with interested parties at Wenatchee and Kennewick and with residents of the valley at different intermediate points. From Wenatchee to Beverly the trip was made in a rowboat, from Beverly to the foot of Priest Rapids by team, and from the latter point to Kennewick by river steamer. At this stage of the river Cabinet Rapids forms no obstruction to navigation, nor is there any serious obstruction at Priest Rapids, though "lining" would be necessary at a number of points. At Rock Island Rapids, however, the currents were so swift, and the channel so obstructed by reefs and bowlders that any attempt to navigate a steamer through the rapids would have been extremely hazardous.

From the results of work heretofore done, from experience of steamboat men familiar with the river, and from what could be seen during the examination, the conclusion has been reached that Rock Island and Priest Rapids can be made navigable at low water only by resort to canalization. The same is also probably true of Cabinet Rapids.

From the Great Northern Railway Bridge to the head of Priest Rapids the river flows through a deep canyon, and the country immediately bordering the river is rocky and sterile. At places there are limited areas under cultivation, and there are other limited areas suitable for cultivation if the land is properly irrigated, but the total area cultivated, or capable of cultivation, that lies near the river, is so small that its products, under the most favorable conditions, will never furnish much river traffic. Back from the river the proportion of arable land becomes considerably greater, but considering the cost of hauling to the river bank it is questionable whether much river traffic will ever originate between these two points. If the radical improvement of these rapids is undertaken, its commercial value will rest not on local commerce, but on through commerce, as with these obstacles overcome and the authorized work on the Columbia River below the mouth of the Snake completed, there will be continuous navigation from Bridgeport to the Pacific Ocean, a distance of about 560 miles.

There is now an annual tonnage on the Columbia River between Wenatchee and Bridgeport of 54,000 tons, the bulk of which is wheat. Even if all of this tonnage was carried to and from Portland by river it would not be sufficient in itself to warrant the probable cost of canalization at the three rapids above referred to, so that the worthiness of this improvement must depend upon prospective commerce. It is difficult to estimate future commerce, but if this region continues to develop as it has in the past there is every reason to believe that the Columbia River, when open for through navigation to the sea, will form an important highway of commerce the benefits from which will be very great.

The prospective development of this country is shown by the fact that the Great Northern Railway Co. is now building a branch line from its Columbia River station to Waterville, which will be completed in time to handle this season's crop, and the same company has just formally announced its intention of building a line from Wenatchee to Oroville, following generally the Columbia and Okanogan River Valleys. The Chicago, Milwaukee & Puget Sound Railway Co. has begun grading for a line along the right bank of the Columbia River, from a point opposite Beverly to Hanford, and surveys are now in progress by the same company for a branch line running north from Beverly. These large railroad investments are a good index of the future commercial importance of this region.

Just what influence these railroads will have upon through river commerce is dependent largely upon the cost of water transportation between Portland, Oreg., and upper Columbia River points. The capacity of the existing upper Columbia River steamers is not large, and owing to the swift currents upstream navigation is expensive, in consequence of which present river rates for local commerce are high. An effort was made to obtain from steamboat men an approximate idea of the cost of carrying wheat by boat over an improved river from Wenatchee and points above to Portland, but without success. One of them even questioned the ability of upper Columbia River boats to successfully compete with the railroads on a 500-mile haul. This view, however, is not held by the undersigned, who believes that an improved river will have a distinct value of its own as a highway of commerce, and that in addition it will serve as a regulator of freight rates over a very large extent of territory. Whether the country has developed sufficiently to warrant the inauguration of this work will depend largely upon the magnitude of the undertaking, and this can be determined only by a complete survey.

In connection with the canalization of these rapids a large amount of power can be developed, particularly at Priest and Rock Island Rapids, and this question should be fully investigated if a survey is authorized. There is now a power plant at Priest Rapids, which develops about 1,200 horsepower. The development of this power required the construction of a small dam across one of the river channels, which was done under revocable permit issued by the Secretary of War. The power is transmitted electrically about 15 miles downstream, and there used principally in pumping water from the river into irrigating ditches, and it is believed that any power developed by the United States could be advantageously disposed of for the same purposes. Similar schemes are under consideration, and if the United States decides to do no work it is probable other power plants will be installed at Priest Rapids under existing State laws.

In the present stage of development on the Columbia River it is not believed that the question of terminal facilities merits serious consideration, at least not in the stretch of river between Wenatchee and the mouth of the Snake, though if any radical improvement is undertaken it would probably be advisable to include in the project the installation of transfer and terminal facilities at the points where the river is crossed by the three transcontinental railway lines, the cost of which should be borne in whole or in part by the city at which they are located.

To determine the cost of an adequate improvement on the Columbia River between the mouth of the Snake and Wenatchee it is recommended that a survey be authorized at an estimated cost of $11,000. This includes an item of $1,000 for expert opinions and assistance in the development of water-power plants as auxiliaries to canal structures.

Such a survey can be advantageously made only at low-water stage, so that it is doubtful whether a complete project can be prepared prior to December 1, 1909.

Very respectfully,

C. W. Kutz,
Major, Corps of Engineers.

The Chief of Engineers, United States Army
(Through the Division Engineer).

[First indorsement.]

United States Engineer Office,
Northern Pacific Division,
San Francisco, Cal., June 14, 1909.

Respectfully forwarded to the Chief of Engineers, United States Army.

It is not thought that any open river treatment of this part of the Columbia would prove satisfactory for navigation. The local traffic would not for many years, if at all, justify the cost of canalization. It is doubtful whether the through navigation would develop sufficiently to warrant the cost, except, perhaps, as a regulator of freight rates.

The railroads are gradually extending to the various points along the river and as soon as constructed the navigation of the river usually closes to those points, due in part of course to the difficulties of the channel. It is a question of cost, however, and the only way to ascertain the cost is by a survey. It is, moreover, considered desirable to have a survey of as important a river as the Columbia.

The recommendation of the district officer is therefore approved.

John Biddle,
Lieut. Col., Corps of Engineers,
Division Engineer.

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., June 28, 1909.

Respectfully returned to the Chief of Engineers, United States Army.

The physical condition of this stretch of the Columbia River is such that a navigable channel can not be maintained by open-river methods. It is equally clear to the board that the cost of canalization would not be justified by the probable resulting advantages solely in the interests of navigation.

As this section of river is susceptible of water-power development, the question is presented whether the development of the water power can be so coordinated with the improvement of the river for navigation as to make it economically justifiable.

The solution of this question can be determined only after a careful investigation and survey, with estimates of cost. The board therefore concurs with the district officer and the division engineer in recommending that a survey be authorized.

For the board:

D. W. LOCKWOOD,
Colonel, Corps of Engineers,
Senior Member of the Board.

[Fourth indorsement.]

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, July 7, 1909.

Respectfully submitted to the Secretary of War.

This is a report on preliminary examination of Columbia River from the mouth of Snake River to Wenatchee, authorized by the river and harbor act of March 3, 1909.

Inviting attention to the report of the Board of Engineers for Rivers and Harbors in the preceding indorsement, I recommend that a survey of the locality, as proposed, be authorized.

W. L. MARSHALL,
Chief of Engineers, U. S. Army.

[Fifth indorsement.]

WAR DEPARTMENT, *July 8, 1909.*

Approved as recommended by the Chief of Engineers.

ROBERT SHAW OLIVER,
Acting Secretary of War.

SURVEY OF COLUMBIA RIVER FROM MOUTH OF SNAKE RIVER TO WENATCHEE, WASH.

UNITED STATES ENGINEER OFFICE,
Seattle, Wash., July 11, 1911.

SIR: In compliance with instructions contained in letter of July 14, 1909, I have the honor to submit the following report upon survey of the Columbia River from mouth of Snake River to Wenatchee. The report on preliminary examination of this section of the Columbia River was dated June 9, 1909, and survey was authorized by the Secretary of War July 8, 1909.

The work of making this survey and preparing estimates of cost was in the immediate charge of Assistant Engineer Eugene Ricksecker, with Junior Engineer H. J. M. Baker in charge of the survey party in the field. Field work was in progress from September 5, 1909, to February 18, 1910, but the submission of the report has been delayed by a number of unavoidable causes, and is now not as complete as could be desired, due to the recent death of Assistant Engineer Ricksecker. Mr. Ricksecker devoted much of his spare time during the past year to a study and consideration of the problems involved in the improvement of this stretch of the Columbia River for purposes of navigation and in the incidental development of power at the principal rapids, and this report is based upon the results of his work and that of A. S. Fleet, draftsman (since transferred to the Portland district). The detailed studies made by them can not be prepared for submission with the report without a considerable amount of work, which does not seem to be warranted.

The survey was limited to the stretch of river between the head of Rock Island Rapids and the mouth of the Snake River, as the 12-mile stretch between Wenatchee and the Rock Island Rapids had been surveyed in 1894 by C. F. B. Haskell, under the direction of Capt. T. W. Symons, Corps of Engineers. The results are plotted on a series of charts (not printed) numbered from 25 to 45, inclusive. This series of numbering is a continuation of that adopted by the Symons survey, above referred to, so that the charts of this river, from the international boundary to the mouth of the Snake River, are all numbered continuously.

In addition to the charts above referred to, detail charts (not printed) of Rock Island Rapids and of Cabinet Rapids are also submitted, together with an index and vicinity map (not printed), which shows the relation of this stretch of the Columbia River to the river as a whole.

Detail charts of Priest Rapids were not made, as large scale charts of these rapids made in 1885 served for the purpose of preparing estimates. Copies of the 1885 charts are not submitted, as the information contained on them is believed to be sufficiently well shown on the charts of 1,000 feet to the inch.

When work was started, the river was not low enough to permit reliable soundings to be taken; therefore the party started in at Beverly, working upstream, mapping only the shore line and adjacent topography, expecting to reach Rock Island Rapids when the river was at a low stage, so that soundings and low-water data could be readily and precisely secured on the down trip. River conditions, however, that year were unfavorable. Starting with a 14.3-foot (Wenatchee) stage on September 5, 1909, it fell to a 7-foot stage on October 31, rose to a 13-foot stage on December 2 (an unusual occurrence), and reached its lowest stage (3 feet) on February 26, 1910. This condition prevented the collection of low-water hydrographic data on the upper stretch of the river, delayed the work, and generally increased the cost. In addition to the general survey of the river, a detail survey was made of the left channel of Rock Island Rapids, as this, upon examination, proved to be best adapted to canalization. Only such portions of Priest Rapids were resurveyed as appeared

likely to be included in comprehensive plans for their improvement. These localities were at the sixth and seventh rapids and the island and opposite shores at the lower end of the rapids.

The azimuth of the initial course of the survey was taken to be the same as that of the Chicago, Milwaukee & Puget Sound Railway bridge across the Columbia River at Beverly. Connection was made between the transit line and the United States Geological Survey triangulation station "Hill." This check on "Hill" showed a difference of 13 feet in azimuth. Bench marks were established at intervals of about a mile and a half, marked where possible by crosses cut into the rock. Wherever practicable connection was made with United States Geological Survey bench marks, and at Kennewick connection was made with the United States Coast and Geodetic Survey bench mark.

Gauges were established at the critical points and readings made covering an entire year. From these hydrographs and from a study of the gauge readings at Wenatchee, which are continuous for a considerable period of time, it was possible to compute approximately the elevations of the water surface at different points corresponding to different stages at Wenatchee. By this means all soundings were reduced to low water of 1910, and so plotted. An equation has been added to each chart by which soundings can be reduced to extreme low water, but this relation between low water of 1910 and extreme low water as computed from the Wenatchee gauge is approximate only, and not to be relied upon at points principally below Priest Rapids, where the river bed is unstable.

In 1894 the Columbia River at Wenatchee reached a 58-foot stage—the highest of which there is any record. The high water at Wenatchee during the last 10 years has ranged from 27.4 to 47.2, with a mean of 38.3. The crest of the flood wave is usually reached in June, and extreme low water usually occurs in February. As in the case of high stages, the extreme low stage is seldom reached, and the average low-water stage is from 2 to 3 feet higher than extreme low water.

No discharge measurements were made in connection with this survey. Such measurements were made several years ago at Entiat, a short distance above Wenatchee, and several measurements were made since by an engineer in the employ of one of the power companies interested in the development of Priest Rapids. Combining these measurements a discharge curve was plotted which shows that the run-off of the Columbia River at Priest Rapids varies from minimum of 28,000 cubic feet per second to an average high water maximum of 335,000 cubic feet per second.

The physical conditions, as shown by the survey of 1909–10, do not differ materially from those described in the report on preliminary examination, except as to Cabinet Rapids, concerning which the opinion was expressed that "they can probably be made navigable at low water only by resort to canalization." The several examinations made of these rapids during the progress of the survey now lead to the belief that they can be materially improved by the removal of bowlders, and that when so improved they will offer no greater obstruction to navigation than do many other stretches of swift water on this river that are successfully navigated. The main channel through these rapids along the right bank carries sufficient water for purposes of navigation, but the current is so swift and bears so strongly against the right bank at the foot of the rapids that navigation is dangerous for any but powerful boats. It is estimated that a 6-foot low-water channel near the left bank can be cleared of bowlders and reefs at a cost not to exceed $25,000.

Other rapids are Nixon, Lodged Pole, Quilamene, Island, Cohasset, and Coyote. All these are unimportant, being short stretches of swift water, most of them disappearing as the river rises above its low stage. It is estimated that the removal of low-water obstructions at these points, aggregating 1,500 cubic yards of rock, will cost $15,000. Between Priest Rapids and the mouth of the Snake there are several short bars that show less than 6 feet of water over them at extreme low water. These bars are located at mile 384, carrying less than 4 feet of water; at miles 372¾, 375½, 396⅓, and several places above Kennewick, all carrying 5 feet of water at extreme low. There is also a long bar above Richmond carrying 3 feet of water at extreme low. The steamers now operating on this portion of the river experience no serious difficulty, probably due to the fact that the river rarely reaches its extreme low stage, and when it does is frequently closed to traffic by ice. It should also be remembered that the extreme low-water depths are computed depths, and that the actual depths below Priest Rapids at that stage may be, and probably are, greater than those indicated. This portion of the river is considered to be in such condition that no improvement is warranted or needed at this time.

The river channel between Wenatchee and the head of Priest Rapids is rather thickly studded with bowlders, and while the survey chart of 1894 shows a channel with depths exceeding 6 feet at low water, it is a tortuous and more or less dangerous one. The estimated cost of removing the worst obstructions is $25,000.

The only important obstacles to navigation in the entire stretch of the river under consideration are Rock Island and Priest Rapids, both of which require canalization. In the preparation of estimates for this work lock chambers of the same size as those adopted for the Dalles-Celilo Canal, 45 feet wide by 310 feet between quoins, have been assumed.

Rock Island.—The river in the left channel has a drop of 12 feet at low water in a distance of 2,700 feet; 6.5 feet at average high water (38.5, Wenatchee) and 4 feet at extreme high, most of the fall lying within a distance of 1,000 feet. In the right channel the fall is distributed over a distance of 5,100 feet. Boats have passed through these rapids on several occasions by lining, using the right channel when the water was above the 10-foot stage, but large rock masses make the trip hazardous, much too dangerous and tedious an operation to be included in a regular run. The right channel was improved by the General Government early in 1892 by removal of certain rocks and the placing of a number of ringbolts for use in lining through. It might be further improved along the same lines, but the work would be an expensive makeshift, inadequate for commercial development. For permanent improvement and economical navigation the construction of a lock is a necessity. The site selected for this lock is shown on the detail sheet of Rock Island Rapids drawn to scale 1 inch to 200 feet. Three other locations for the lock were considered, but from the standpoint of economy the site selected is the most advantageous.

The lock, as planned, is to be of concrete with steel mitering gates. The top of the upper gate is at the elevation of extreme high water

and the walls are 6 feet higher. Considering navigation alone, this height is probably unnecessary as at high stages boats could navigate the right channel, but to insure the continuous development of power, which is essential to the commercial success of any work at this point, the walls should be carried to the height indicated.

The present low-water flow through the left channel is approximately 10,000 second-feet, and it is estimated that a low-water head of 11 feet at the lock can be secured without appreciably reducing the flow in the left channel, thus permitting the development of about 8,000 horsepower under an assumed generator and turbine efficiency of 66 per cent. As the river rises the head decreases, but the flow largely increases, so that with a suitable number of turbines supplemented by fall increasers about 12,000 horsepower can be developed when the river at Wenatchee is at the 8½-foot stage. Above this stage the power developed would decrease, due to the decreasing head, unless the number of turbines was still further increased. The determination of the most advantageous power installation is a matter that calls for more extended discharge measurements in the two channels, but for purposes of estimate it is not safe to count on the development of more than 8,000 horsepower. The annual periods when more than 8,000 horsepower could be created economically occur in the spring and fall while the peak of the demand curve will occur in midsummer for irrigation pumping and in midwinter for lighting, so that the peak power would have no commercial value.

There is no market for power in the immediate vicinity of Rock Island Rapids, but with the steady increase in the amount of land in the Columbia River Valley that is being irrigated by pumping it is believed that a market within economic radius would eventually be obtained for the full amount of power that could be generated during the irrigating season. To obtain a market for the power that would be available for the balance of the year would involve greater difficulty and maximum returns from the amount invested in the power plant could not be expected until the surrounding country is further developed.

The estimated cost of this plan of improvement, exclusive of power house and machinery, is as follows:

Lock and approaches:	
37,700 cubic yards rock excavation, at $4	$140,800
42,400 cubic yards concrete, at $10	424,000
19,000 cubic yards fill, at 30 cents	5,700
Lock gates:	
1,430,000 pounds, at 10 cents	143,000
Gates, anchorages, valves, operating machinery, etc	32,000
Lock-keepers' dwellings	7,600
Cofferdam:	
23,000 cubic yards rock fill, at $2	46,000
14,000 linear feet piling, at 40 cents	5,600
200,000 feet b. m. lumber, at $50	10,000
Concrete dam:	
39,200 cubic yards concrete, at $10	392,000
11,000 cubic yards rock fill, at $2	22,000
	1,228,700
Engineering and contingencies, about 15 per cent	181,300
Total	1,410,000

Preliminary designs of a power plant indicate that the cost would amount to approximately $55 per horsepower, or, allowing for spare units, about $500,000—making the total cost $1,910,000.

Assuming that the entire output can be sold at the power plant at $15 per horsepower, and capitalizing this gross income on a 10 per cent basis, the power development at Rock Island Rapids will represent an investment of $1,200,000, and make the net cost, so far as navigation is concerned, $710,000. It may be alleged that a gross income of 10 per cent is greater than the United States should expect upon its investment when it is able to borrow money for 3 per cent, or even less. Taking into consideration, however, the operating expenses, and making due allowance for repairs, depreciation, accidental damages, which in a commercial plant would be covered by insurance, and the possible failure to market all the power developed, it does not seem businesslike to make estimates on a more liberal basis. The United States is the owner of the islands in the river at this point, and it is not practicable to develop power in any quantity without making use of one or more of these islands. For this reason it is believed that the United States, if it undertook to develop power at this point, would not be involved in any controversy over water-power rights that may have been or may in future be granted by the State of Washington.

The project outlined contemplates leaving the right-hand channel in its natural condition. By throwing a low dam across this channel the possibilities for power development can be greatly increased, at the same time improving the channel for navigation between Rock Island and Wenatchee. The present limited market for power in this vicinity, and the fact that such a dam would merely reduce but not entirely obviate the necessity for work between Rock Island and Wenatchee, led to the conclusion that such a dam should not be included in the project at this time.

Priest Rapids.—This is a stretch of swift water extending over a distance of 9¾ miles and having a total fall of 68 feet at extreme low water and 67 feet at extreme high water. The obstructions to navigation are confined to seven rapids, with quieter reaches between, the worst obstructions being at the first, second, third, sixth, and seventh rapids. The fall at the first three was 29 feet at low water of 1910, probably 28.7 feet at extreme low and 17 feet at extreme high water, the distance being 2½ miles. The fall at the sixth and seventh rapids is 11.9 feet at extreme low, in a distance of 3,400 feet.

A number of plans for the improvement of these rapids have been considered. First, the construction of a lateral canal on the left bank of the river from the head of the rapids to the foot of the rapids, with three locks of approximately equal lift, two at the lower end of the rapids and one about halfway up at the site indicated on sheet 33 (not printed). This plan contemplates using Moran Slough (now dry) as a part of the canal trunk. The axis of this canal is designated on the charts as "Project N." The canal section assumed in the estimates is the same as that adopted for The Dalles-Celilo Canal—bottom width 65 feet and a depth of 6 feet at extreme low water. The upper lock is planned for an ordinary high-water stage, the water entering the canal above the stage to be carried off by a spillway placed at the lower end of a through cut above the upper lock.

This plan is designed primarily for navigation, but it is proposed to allow a velocity of 2.7 feet per second so that power can be developed at both the upper and lower locks. At the upper lock site this amounts to about 1,800 horsepower at extreme low water, and at the lower lock site to 4,000 horsepower at the same stage. As the river rises the first of these amounts increases, due to increased flow in the canal above the upper lock, while the second decreases, due to decreased head. By operating the two power houses in conjunction, 5,800 horsepower can be developed throughout the year.

The estimated cost of this project, exclusive of power houses, power machinery, and auxiliaries thereto, amounts to $3,700,000, and the excluded items will cost $360,000, a total of $4,060,000. Power here will have an equal or greater value than at Rock Island, but assuming the same value the power plants of the "N" project will represent an investment of $870,000, making the net cost in the interest of navigation about $3,200,000.

With the expectation of reducing the net cost to the United States a second project was prepared, designated as project "P." This consists of a canal located on the left bank of the river suitable for navigation purposes, but built with a view to developing power. This canal is designed with a bottom width of 200 feet, side slopes of 1 on 1 and 2 on 3 to carry 10 feet at extreme low water. This will leave the river at Bend, lie in through cut for a distance of 1⅓ miles, will have a spillway and regulating gates where it emerges from the through cut to care for the flow at river stages higher than the average high water, these features and its alignment being common to the "N" project to this point. The remainder of the canal to be in balanced cut and fill with lower portion lined with reenforced concrete. A flight of three locks at the lower end of Priest Rapids will overcome the total fall of the rapids and hold the water in the canal at the level of the river at upper end of the rapids.

In the vicinity of the locks pressure mains will lead water to a power house located on the river bank below the locks. The minimum flow corresponding to a zero (Wenatchee) stage will yield 24,000 horsepower, and the minimum during the irrigation season, April 15 to September 15, as shown by the records of the last five years, corresponding to 6½-foot (Wenatchee) stage will yield 35,000 horsepower.

The estimated cost of this project, exclusive of power house, power machinery, and auxiliaries, is $7,000,000, and the excluded items will cost $1,750,000—a total of $8,750,000. Assuming that the power continues throughout the year, 24,000 horsepower can can be marketed at $15, that the excess, 11,000 horsepower, developed during the irrigation season, can be marketed at $10, and, capitalizing the gross income at 10 per cent, the power investment would amount to $4,700,000 and the net investment for the benefit of navigation would amount to $4,050,000.

Comparison with the "N" project shows that by increasing the dimensions of the canal the net cost has been increased instead of decreased. In other words, it is apparently not economical to develop the power of Priest Rapids in this manner unless it can be marketed at prices greater than those assumed.

The Columbia Valley Reclamation Co. is proposing to develop part of the power of Priest Rapids by the construction of a lateral canal on the left bank of the river similar to project "P," outlined above, differing, however, from the latter in that power is developed at two points and Moran Slough is used as a reservoir. It is understood that the right of way for this project has been entirely acquired, partly from the State and partly from individuals, and some work has been done during the past year by a steam shovel. This work has been desultory in character, and is apparently for the purpose of keeping alive the company's water rights.

It is possible that a modification of the "P" project, to make it conform more closely to the project of the Columbia Valley Reclamation Co., would result in decreased cost or in increased power development, but revised estimates were not made, as the information obtained was sufficient to show that, whatever arrangement was adopted, a lateral canal would be far more costly than the "L" project, to be described hereafter.

Part of the power of Priest Rapids was developed a number of years ago by the Hanford Irrigation & Power Co., now the Washington Irrigation & Development Co., by means of a canal on the right bank of the river, at the head of which a small crib dam was thrown across one of the channels into which the river divides at low water. This dam was authorized by revocable permit issued by the Secretary of War on April 21, 1906. The primary development amounted to 1,200 horsepower and a year ago was increased to 2,400 horsepower.

With the object of utilizing the Hanford Canal an outline plan was prepared, designated as project "H," which contemplates extending this canal in both directions, deepening it, and constructing two locks at the lower end to overcome the fall of the first, second, and third rapids. The open river is to be used through the fourth and fifth rapids and a single lock constructed to overcome the fall of the river at the sixth and seventh rapids.

This project would involve the excavation of a large amount of rock, estimated at 895,000 cubic yards, and the total cost would exceed $6,000,000. This could be reduced either by developing power or by cooperating with the power company whereby it would bear part of the expense in return for the privilege of developing the increased power, but as a superficial examination showed that this plan was not an economical one, either from a power or navigation standpoint, further consideration was abandoned.

The fourth project, designated as project "L," contemplates the construction of a longitudinal dam in the river, founded on the three rocky islands shown on the map, with a flight of two locks at the lower end to overcome the fall in the first, second, and third rapids at all stages of the river. Above the third rapids the project is identical with the "H" project, that is, it involves the use of the open river through the fourth and fifth rapids and the construction of a single lock at the sixth and seventh rapids to overcome the difference in level from extreme low water to 30-foot (Wenatchee) stage. Above this stage boats will use the open river. No provision is made for the development of any power at the upper (single) lock, but at the lower lock 18,000 horsepower can be developed continuously throughout the year, with 12,000 horsepower additional during the irrigation season, April 15 to September 15.

The estimated cost of this project, not including power development, is as follows:

PROJECT "L."

FIRST AND THIRD RAPIDS.

Two locks in flight:	
27,800 cubic yards rock excavation, at $4	$111,200
50,000 cubic yards concrete, at $10	500,000
11,000 cubic yards fill, at 30 cents	3,300
Lock gates, 865,200 pounds, at 10 cents	86,520
Dam:	
22,000 cubic yards rock excavation, at $4	88,000
146,000 cubic yards concrete, at $10	1,460,000
37,800 cubic yards fill, at 30 cents	11,340

SIXTH AND SEVENTH RAPIDS.

Single lock:	
11,000 cubic yards rock excavation, at $4	44,000
25,300 cubic yards concrete, at $10	253,000
8,300 cubic yards fill, at 30 cents	2,490
Lock gates, 630,000 pounds, at 10 cents	63,000
Dam:	
2,200 cubic yards rock excavation, at $4	8,800
15,100 cubic yards concrete, at $10	151,000
General:	
Gate anchorages, valves, operating machinery, etc	90,000
Lock keeper's houses	13,800
Cofferdams	80,000
Engineering and contingencies, 15 per cent	433,550
Total	3,400,000
The power house, machinery, etc., necessary to develop 30,000 horsepower is estimated to cost	1,650,000
	5,050,000
If all the power can be sold to a distributing company at $15 and $10 per horsepower, the income will amount to $390,000, representing a power investment of	3,900,000
Thus making the net investment for purposes of navigation	1,150,000

In the "N" and "P" projects allowance was made in the estimates for purchase of right of way at prices which represent the value of the land for agricultural purposes, but nothing was included for the water rights of the Columbia Valley Reclamation Co. These rights would unquestionably have to be acquired if the projects are to be carried out, but the cost is wholly a matter of conjecture. If based on work actually done it would be small, but if based on prospective profits it would probably be large.

The "L" project is the only one that could be executed without acquiring right of way from either one or the other of the two companies now in the field, and even in this project some doubt exists as to the ownership of the three islands upon which the longitudinal dam rests. These islands were shown on the official land-office plat of the Interior Department made prior to the admission of Washington as a State. The islands, however, were not meandered and it is admitted that they are annually submerged by ordinary high water. By reason of their annual submergence, title to these islands was claimed by the State of Washington, and within the past year it duly conveyed this title to the Washington Irrigation & Development Co. Prior to that time, however, at the request of this office, an Executive order had been issued (No. 1207, May 27, 1910), under the terms of which these islands were withdrawn from entry and reserved for the use of the War Department in connection with the improvement of the river. This doubt as to ownership does not affect in any way the right of the United States to execute this project in the interest of navigation, for its jurisdiction in such matters extends to high-water mark.

In December, 1910, the Washington Irrigation & Development Co. filed plans for the enlargement of its plant to a capacity of 30,000 horsepower. Its plans for this enlargement contemplated a longitudinal dam in the river resting on the islands above referred to, similar in this respect to the "L" project, with a canal at the lower end leading to a power house on the right bank adjoining the present power house. Permission to erect these structures was denied by the Chief of Engineers, on the grounds that the islands were Government property, or at least would be so considered until the Washington Irrigation & Development Co. had proved its title, and that there was no authority of law that would permit the permanent occupancy of Government land.

The ultimate aim of this company is to develop the entire power of Priest Rapids by the construction of a high dam across the river, drowning out all the rapids. In connection with complete development, it is understood that the company is willing to construct a flight of locks without cost to the United States and provide the necessary power for operating them. It is not willing to assume the construction of locks in connection with its proposed 30,000 horsepower installation, but will furnish power for operating such locks if constructed by the United States.

The next question that arises concerns the right of the United States to develop the power of these rapids in excess of the amount required for the operation of structures erected in the interest of navigation. The State of Washington recognizes the paramount interest of the United States so far as navigation is concerned, but claims title to the bed and consequently to the power of all navigable streams within its borders. Its laws provide for the development and utilization of this power through a system of filing, under the terms of which prospective users must post notices of their intentions and file copies of their notices with designated authorities. In the acquisition of water rights by this method the principle prevails of "first in time first in right."

Acting under these laws the Hanford Irrigation & Power Co., a number of years ago, filed on the entire low-water flow of the Columbia River at Priest Rapids, but as it has thus far only applied to beneficial use a small part of this flow it is questionable as to how far its rights extend. On the left bank of the river the Columbia Valley Reclamation Co. has also made or acquired filings on the flow of the Columbia River. These filings, it is understood, are subsequent to the filings of the Hanford Irrigation & Power Co.

Very little development work has been done by the Columbia Valley Reclamation Co., nevertheless its water rights as well as those of the Hanford Irrigation & Power Co. (Washington Irrigation & Development Co.) have a property value which must be recognized in any plan for the improvement of navigation which

involves the creation of power to an extent that will encroach upon the rights of these companies.

A lateral canal, such as is contemplated in the "N" and "P" projects, would provide a better means of surmounting these rapids than the "L" project, but the cost, even assuming the incidental development of power, is believed to be prohibitive. The "L" project would provide means of passing the worst obstructions and permit regular traffic. Its cost, if power is developed, is very much less than any of the other projects and the resulting waterway would be in keeping with the remainder of the river which contains a number of reaches of swift water that will necessitate lining during periods of low water.

The total cost of improving the Columbia River between Wenatchee and the mouth of the Snake River in the manner outlined above would be:

Above Rock Island Rapids	$25,000
Rock Island Rapids (net cost)	710,000
Cabinet Rapids	25,000
Cabinet Rapids to Priest Rapids	15,000
Priest Rapids, "L" project (net cost)	1,150,000
Total	1,925,000

The actual expenditure to carry out the project would exceed this amount by $5,100,000, making the total expenditure $7,025,000.

The cost of operation and maintenance of the locks is estimated at $50,000, about three times the cost of maintaining and operating the single lock at the Cascades. This is based on the assumption that the same crew will operate both locks at the lower end of Priest Rapids.

COMMERCE.

The present local commerce of the river was described in the report on preliminary examination and the only changes since are a slight decrease in tonnage below Priest Rapids from 11,712 tons to 10,035 tons, and a decrease in the section above Wenatchee from 54,000 tons to 23,722 tons. The latter decrease was due to the construction of the Waterville branch of the Great Northern Railway, which now carries the greater part of the wheat formerly shipped to Wenatchee by boat. No local commerce has developed between Trinidad, on the Great Northern Railway, and Beverly, on the Chicago, Milwaukee & Puget Sound Railway, though there is ample depth for river steamers throughout the year, nor is there any local commerce between Wenatchee and Rock Island Rapids.

As no work is proposed below Priest Rapids and as there is not sufficient population to create even local commerce on the existing stretches of good water, any improvement, if made, will be for the benefit of commerce originating in or destined to Wenatchee plus the local commerce on the river above Wenatchee.

Wenatchee has a population of 4,050 and is the commercial center of an irrigated area of 20,000 acres, devoted principally to the raising of apples. It is not a manufacturing town. If the Columbia River were navigable to Portland, some apples would be shipped to the Pacific coast by that route, but the tonnage would be small. Some of the miscellaneous supplies which the people of Wenatchee use would come by the river, if navigable, but it would mean a 380-mile haul against the swift currents of the Columbia, as compared with a 165-mile rail haul across the Cascade Mountains.

The construction of a railroad along the Pend Oreille River from Newport to Box Canyon, 60 miles, resulted in putting out of business all the steamers on that river (five in number), as they were unable to successfully compete with the railroad. The general manager of the Columbia & Okanogan Steamboat Co., operating on the Columbia River between Wenatchee and Bridgeport, states that his boats will all be withdrawn if a railroad is built between the towns named. These two cases indicate that boats on rivers of this character can not compete with the railroads in the carrying of passengers and package freight, and that unless there is sufficient bulky freight to justify a regular continuous service they do not operate at all.

Very little interest has been shown in the project except by the Open River Transportation Co., whose letters on the subject in response to a series of questions are appended hereto. The letters have received careful consideration, but, even assuming as correct the statements made as to the cost of water transportation on the Columbia River, the amount of traffic in prospect is not sufficient in my judgment to warrant the investment of $7,025,000, even if $5,100,000 of this amount is income producing.

In most canalization projects on navigable streams the creation of power is incidental to the improvement for navigation, but in this case the power created will do far more to develop the country and increase its prosperity than will the providing of a navigable channel; in other words, Priest Rapids and Rock Island Rapids should be developed primarily for power with incidental consideration for the needs of navigation. To prosecute such a development economically means that it must be gradual so as to keep pace with the demands for power, and yet each step must conform to a comprehensive plan in order that when completed the full power of the rapids will be developed and suitable provision made for navigation.

There is immediate need for additional power in the Columbia River Valley, but no real present need for navigation between Wenatchee and the mouth of the Snake River. For this reason the problem should be approached from a power standpoint. If the United States possesses a legal right to develop the power of this river it then becomes a question of policy as to whether it should proceed on a power basis or whether the creation of power should be left to private enterprise.

Unless the United States is willing to adopt the methods in use by commercial power companies—that is, advertise, educate the people, and thereby create a demand for its output—it will be advantageous to leave the question of power development to private companies. This course need not involve the United States in any financial loss nor need it cause the loss of any right to guard against monopoly—for in the granting of permits to build structures in these waters conditions can be imposed which will safeguard these as well as any other rights which the public possesses.

Considering the cost, the uncertainty as to the right of the United States to develop power in excess of its own requirements, and the limited amount of commerce to be benefited, I am of the opinion that the improvement of the Columbia River from the mouth of

chee is a work not worthy of being undertaken
t the present time.
ed.

C. W. KUTZ,
Major, Corps of Engineers.

NEERS, UNITED STATES ARMY
Division Engineer).

[First indorsement.]

NITED STATES ENGINEER OFFICE,
NORTHERN PACIFIC DIVISION,
San Francisco, Cal., July 17, 1911.

led to the Chief of Engineers, United States
ne views of the district officer.

JOHN BIDDLE,
Colonel, Corps of Engineers,
Division Engineer.

Board of Engineers for Rivers and Harbors,

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