INTERIM REPORT

OF THE

INTERNATIONAL JOINT COMMISSION

ON THE

CHAMPLAIN WATERWAY

WASHINGTON - OTTAWA
1937

OTTAWA
J. O. PATENAUDE, I.S.O.
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1938

PREFACE

The complete record of Public Hearings, which is summarized in Part IV of this Report, is filed in the offices of the Commission at Washington and Ottawa. There will also be found in the Commission's offices the Final Arguments at Washington, April, 1937; and the Briefs filed on behalf of various interests.

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I

INTRODUCTION

Under date of January 2, 1936, the Government of the United States communicated to the Commission for investigation and report, under the terms of Article IX of the Treaty of January 11, 1909, the following Reference:—

> Section 4 of the Act of Congress entitled "An Act authorizing the construction, repair, and preservation of certain public works, on rivers and harbors, and for other purposes," approved August 30, 1935, contains the following provision:—
>
> > That the International Joint Commission created by the treaty between the United States and Great Britain relating to boundary waters between the United States and Canada, signed at Washington January 11, 1909, under the provisions of article 9 of said treaty, is requested to investigate the advisability of the improvement of a waterway from Montreal through Lake Champlain to connect with the Hudson River, together with the estimated cost thereof, and to report to the Dominion of Canada and to the Congress of the United States, with its recommendations for co-operation by the United States with the Dominion of Canada in the improvement of said river.
>
> It is understood that the United States Section and the Canadian Section of the International Joint Commission have conferred in regard to the provisions of law quoted and that the two Sections concur in the view that the reference should be called to the attention of both Sections of the Commission by the Department of State.
>
> According, the matter is hereby brought to the attention of the Commission. I request that the Commission treat the question defined by Section 4 of the Act of August 30, 1935, as being referred to the Commission by the United States under Article 9 of the Convention of January 11, 1909, between the United States and Great Britain for investigation, report and recommendations.

On February 7, 1936, the Government of Canada concurred in the Reference in the following terms:—

> I have the honour, at the request of the Government of the United States, to transmit to you a communication from Mr. Hull, the Secretary of State of the United States of America, dated 2nd January, 1936. It is my understanding that this communication has already been transmitted to the United States Section of the Commission, and that the enclosed communication is intended for the information of the members of the Canadian Section.
>
> The communication involves the reference to the Commission of the investigation of the Montreal-Lake Champlain-Hudson River waterway. The Canadian Government is willing to participate in the reference, and has so informed the Government of the United States.

Engineers Designated

Before the Commission entered upon the preliminary stages of the investigation called for by the foregoing Reference, it was officially advised that Colonel E. L. Daley, District Engineer of the United States Corps of Engineers in charge of the First District, New York City, had been designated by the Government

of the United States, and that Mr. Guy A. Lindsay, Designing Engineer, Department of Transport of Canada, and Mr. J. Lucien Dansereau, District Engineer, Department of Public Works of Canada, had been similarly designated by the Government of Canada, to act as technical advisers to the Commission in this matter.

Scope of Reference

While, as will appear later in this Report, the Commission interpreted the terms of the Reference as requiring it to report particularly upon the advisability of improving the existing waterway between Montreal and the Hudson River by way of the St. Lawrence River, the Richelieu River and Lake Champlain, it deemed it desirable to ascertain at the outset which of the various possible routes between the St. Lawrence and the Hudson was the most practicable from an engineering and an economic point of view.

Instructions to Engineers

After conferring with the Engineers, the Commission instructed them to prepare for its information a report to include estimates of the cost of a 27-foot channel (with depth of 30 feet for all lock sills in order to conform to the locks of the proposed St. Lawrence waterway) on all the proposed routes between the St. Lawrence River and the Hudson River, and also estimates of the cost of a 14-foot channel and a 12-foot channel on whatever route should be considered the most economical, together with data as to possible tonnage on the projected waterway and such other material as might be of value to the Commission.

Engineers' Report

This Report was prepared and submitted to the Commission on March 15, 1937, and is printed as an Appendix to the Commission's own Report now submitted. It may be very briefly summarized as follows:—

The construction of a waterway of 12-foot, 14-foot, or 27-foot depth from Montreal through Lake Champlain to connect with the Hudson River, by any one of several routes, is feasible from an engineering standpoint.

For a depth of 12 or 14 feet, the most satisfactory route is from Montreal down the St. Lawrence to Sorel; thence up the Richelieu River to Lake Champlain; thence through Lake Champlain, the Narrows, and the Champlain Division of the New York State Barge Canal; and thence down the upper Hudson River to Albany. From data to hand, lacking actual survey data, it is believed that the same route would be most satisfactory for construction of a 27-foot waterway.

The capital cost and annual carrying charges for the construction of a 12-foot waterway, a 14-foot waterway, and a 27-foot waterway, respectively, as well as the maximum potential annual savings in transportation costs, are estimated on the basis of available information.

Existing Water Routes

It will be noted that at the present time there are three water thoroughfares from the St. Lawrence system, including the Great Lakes, to the Atlantic seaboard: the New York State Barge Canal from Tonawanda on the Niagara River to Waterford on the Hudson; the Oswego Branch of the Barge Canal from Oswego on Lake Ontario to connect with the main division of the Canal at Three Rivers Point, just west of Lake Oneida; and the water route from the St. Lawrence to the Hudson by way of the Richelieu River and Lake Champlain.

Richelieu All-Water Route

A detailed description of the first two of these routes will be found in the Engineers' Report, in the Appendix to this Report. The third route may be more particularly described. From Montreal to the mouth of the Richelieu at Sorel, the Canadian Government is improving the natural channel of the St. Lawrence River to provide a depth of 35 feet. The Richelieu River, which connects Lake Champlain with the St. Lawrence after a course of about 80 miles, is navigable from the St. Lawrence to the St. Ours lock, a distance of 14 miles, with a depth of 12 feet. The St. Ours lock is 339 feet long and 45 feet wide, with a depth of 12 feet over the sills. From this lock to Chambly, a distance of 32 miles, the river has a controlling depth of 7 feet, and is at present being improved to 12 feet. The Chambly Rapids, which extend from Chambly to St. Johns, are overcome by the Chambly Canal, 11·76 miles long. The canal has 8 lift locks and one guard lock. The smallest lock is 120 feet long and 23 feet wide, with a depth of 6·5 feet over the sills. The total lift through the canal is 71·5 feet.

The river is navigable from the Chambly Canal at St. Johns to the international boundary, a distance of 23 miles, with a depth of 7 feet. The total fall in the river at mean stage from lake Champlain to the St. Lawrence River at Sorel is 80·3 feet. All bridges over the navigation channel through the Richelieu River and over the Chambly Canal are of a moveable type with no restrictions as to vertical clearances.

Lake Champlain

Lake Champlain is 112 miles long by 9 miles wide at its widest point. The outflow from the lake is controlled by the section of the Richelieu River at the head of the St. Johns Rapids at St. Johns. The lake has an area of 436 square miles, 419 of which are in the United States and 17 in Canada. A narrow arm, 37 miles in length, at the southern end of the lake, known as the Narrows, varies from a few hundred feet to a mile in width, with controlling depth of 12 feet.

Champlain Canal

Navigation is provided from the southern end of Lake Champlain to tidewater of the Hudson River at Troy, New York, through the Champlain Division of the New York State barge canal from Whitehall to Waterford and the canalized upper Hudson from Waterford to the United States lock and dam at Troy. The depth throughout this portion of the existing waterway is 12 feet. The tidal Hudson from Troy to Albany has been improved to provide a depth of 12 feet. From Albany to New York harbour a depth of 27 feet and minimum width of 300 feet has been provided. The mean range of tide at the Troy dam is 4·7 feet, at Albany 4·6 feet, and at the Battery, New York City, 4·4 feet.

Terminal Facilities

The following terminal facilities exist at the present time along the route from Albany to Montreal:—

At the head of deep water on the Hudson River, the Albany Port District Commission owns and operates 5,400 feet of wharfage, having an available depth of 27 feet and providing adequate berthage for 14 ocean vessels. Of the total wharfage, 4,200 feet are on the Albany side of the river, and 1,200 feet on the Rensselear side. A 13,500,000 bushel capacity grain elevator equipped with loading and unloading facilities for both water and rail transportation is operated by the same agency. Adjacent to the wharves are six storage sheds having a total of 280,000 square feet of floor space, and a warehouse having 108,000 square feet of floor space. Also at Albany are the terminals of nine of the larger oil companies of the United States.

The State of New York has provided terminal facilities on the Champlain Division of the Barge canal and private interests have provided similar facilities on Lake Champlain suitable for present barge canal traffic.

On the Richelieu River north of the international boundary there are wharves at Boyan, St. Paul, Ile aux Noix, Sabrevois, St. Johns, Iberville, Chambly, St. Mathias, Beloeil, St. Hilaire, St. Charles, St. Marc, Larue, St. Denis, St. Antoine, St. Roch, St. Ours and Sainte-Victoire. These are mostly of timber construction with depths of water of from 8 to 9 feet alongside. The main commodities handled over these wharves are coal, hay and farm produce. The Canadian Industries Limited at their plant, three miles south of Beloeil, have a concrete wharf of 80 feet long, with a depth of 8 feet alongside.

At Sorel, at the junction of the Richelieu and St. Lawrence Rivers, there are 4,070 feet of concrete wharves with a depth of 27 feet alongside, and 3,000 feet of wharves with depths ranging from 10 feet to 20 feet. There is a modern grain elevator of 3,000,000 bushel capacity equipped with loading and unloading facilities for both water and rail transportation. There are several storage sheds having a total of 50,000 square feet of floor space.

Montreal Harbour, the head of deep draft navigation on the St. Lawrence River, 46 miles above Sorel, is a National Port, administered and operated by the National Harbours Board of Canada. It has a total of 10 miles of piers and wharves with depths alongside ranging from 20 to 35 feet; four grain elevators with a total capacity of 15,162,000 bushels; 20 two-story and 6 one-story transit sheds with a total of 2,100,000 square feet of floor space; and a modern ten-story cold storage warehouse with a capacity of 4,628,000 cubic feet. The Canadian Vickers Limited operate a self-docking floating dock of 25,000 tons capacity as well as a modern ship repair plant. There are numerous cargo handling derricks, cranes and coal unloaders. Various oil companies have large plants for the receipt and distribution of petroleum products.

Existing Traffic

Vessel traffic on the Richelieu River is confined almost wholly to barges. During the past few years, two of the paper companies in Canada exporting paper to the United States have built Diesel-powered barges especially designed for use on this waterway. The typical Diesel-powered barge is 113 feet long and 22 feet wide, with a capacity of 235 tons at a draft of 6·5 feet. In addition to these barges others of greater draft operate on Lake Champlain and the Champlain Canal, with their controlling depth of 12 feet.

The present traffic by the Richelieu route is indicated in the figures for 1935 of traffic on the Chambly Canal. The total movement amounted to 44,200 tons, of which 35,900 tons moved south-bound and 8,300 tons north-bound. Of the total traffic 20,400 tons moved between Canadian ports and consisted of 12,800 tons of ore destined from Sorel to Beloeil, and 7,600 tons of miscellaneous commodities. The movement from Canadian to United States ports amounted to 16,500 tons of which 11,200 tons were newsprint paper. The movement from United States to Canada amounted to 7,400 tons, about equally divided between hard and soft coal and sand, gravel and stone.

Public Hearings

In October, 1936, the Commission advised all interested parties that public hearings would be held, and they were in due course held, in the cities of New York, Albany, N.Y., Burlington, Vt., Plattsburg, N.Y., and Montreal, Canada, between November 19 and November 27, and subsequently similar hearings were held in the City of Boston on April 1 and 2, 1937. Finally, the Commission heard arguments on behalf of the various interests in the City of Washington on April 6, 1937.

Many witnesses gave testimony before the Commission at the various public hearings, both for and against the proposed waterway, and a very

considerable mass of evidence was made available for the information of the Commission on every phase of the subject, the complete record of which is filed in the offices of the Commission, and summarized as Part IV of this Report.

An examination of this record will show that, while the waterway was advocated by a number of organizations and individuals, and particularly by the Champlain Valley Council, representing municipalities and interests in the States of New York and Vermont and along the Richelieu River in Canada, it was opposed by various public bodies in both the United States and Canada.

Proponents

Mr. F. S. Keiser of Duluth, who acted as Counsel for the Champlain Valley Council, relied very largely upon the *Survey of the Great Lakes-St. Lawrence Seaway and Power Project* (Senate Document No. 116, 73rd Congress, 2nd Session, 1934) for the economic side of his evidence, and called as one of his principal witnesses, Mr. Leland Olds, an economist of the New York State Power Authority.

Among the organizations that were represented at the various hearings in support of the Champlain waterway were the Plattsburg Chamber of Commerce, the City of Burlington, Vt., the Toledo Chamber of Commerce, the Detroit Chamber of Commerce, the St. Johns Board of Trade, the Sorel Board of Trade, the Iberville Board of Trade, the Vermont-New York Slate Manufacturing Association, the Champlain Valley Fruit Company, and the National Seaway Council.

Opponents

Among the organizations that opposed the project were the New York State Waterways Association, the New York State Economic Council, the Anthracite Institute of New York, the Maritime Association of the Port of New York, the Merchants Association of New York, the Harbor Carriers of the Port of New York, the Boston Port Authority, the Boston Grain and Flour Exchange, the Maritime Association of the Boston Chamber of Commerce, the New England Council, the Foreign Commerce Club of Boston, the Albany Port District Commission, the Port of Portland Authority, the Montreal Board of Trade, the Montreal Chambre de Commerce, the Delaware and Hudson Railroad, Central Vermont Railway, New York Central Railroad, Rutland Railroad, Boston and Maine Railroad, Boston and Albany Railroad, New York, New Haven and Hartford Railroad, Canadian Pacific Railway, Canadian National Railways, the Brotherhood of Locomotive Engineers, the Brotherhood of Railway Trainmen, and various Chambers of Commerce in the State of New York and the New England States.

Briefs

Briefs were filed with the Commission on behalf of the Railway Association of Canada, the Dominion Legislative Committee of the Railway Transportation Brotherhood, the New York State Waterways Association, the Champlain Valley Council, the National Coal Association, the Brotherhood of Locomotive Engineers, the Buffalo Chamber of Commerce, the Chambre de Commerce of Montreal, the Associated Railroads of New York State, the Rutland Railroad, the Maritime Association of the Port of New York, the Anthracite Institute, the Montreal Light, Heat and Power Consolidated, and the Interprovincial Lumber Company.

Final Arguments

Final arguments in the case were heard by the Commission in Washington on April 6, 1937, at which the Champlain Valley Council, the railway companies and other interests supporting or opposing the waterway were represented.

Scope of Evidence

In analyzing the testimony, briefs and arguments submitted to the Commission in this Investigation, it is well in the first instance to note that the principal witness for the proponents, Mr. Leland Olds, said in defining his attitude toward the proposed Champlain waterway: "I consider the thing as economically important as an extension of the Great Lakes-St. Lawrence seaway, not as a separate waterway project." Mr. F. S. Keiser added, "I may add that it is the contention of the Champlain Valley Council, and, as far as I know, of most of the proponents of this project, that it is economically sound in conjunction with the St. Lawrence development, and is not economically sound otherwise."

Case for Proponents

The case for the proponents embraced, among others, the following points:—

(1) The Champlain route would, they said, afford a direct natural connection for cargo vessels moving between the Great Lakes area, with a population of 42,000,000, manufactures valued at $28,000,000,000, and raw materials worth $16,000,000,000, and the Atlantic seaboard, with a population of 50,000,000, a manufacturing output of $33,000,000,000, and raw materials of $16,000,000,000; and also between the Great Lakes and the Gulf of Mexico area with its population of 20,000,000, a manufacturing output of $4,300,000,000 and raw materials of $2,685,000,000; and finally between the Great Lakes and the Pacific coast area, with its population of 10,000,000, a manufacturing output of $5,000,000,000, and raw materials of $2,000,000,000.

(2) On the basis of these totals and in the light of the experience of the Panama Canal, it was estimated that the Champlain route would have available, very early in its history, approximately 12,000,000 tons of traffic, inter-coastal and foreign. It was believed that "the entire Great Lakes-St. Lawrence seaway project, including the Champlain cut-off, will mean a saving closely approximating $100,000,000 a year in the cost of transportation."

(3) Contrasting the proposed route with the route through the Gulf and the open sea to the Atlantic seaboard, it was stated that the Champlain waterway meant a saving of 1,300 miles.

(4) It was argued that, as between barge canals and deep artificial waterways, the only cheap transportation was over the deep route, with a channel of at least 20 feet. Any depth under that was uneconomical.

(5) Export and import traffic was not so important for the waterway as coastwise and inter-coastal traffic. Experience showed that the former amounted to less than 25 per cent.

(6) Business was handled to-day on a narrow margin of profit, and cheap transportation had therefore become a vital factor in the problem.

(7) Freight rates had been increasing on the railways, and it was said that "we have long since reached the saturation point in the United States." This accounted for a rapid increase in package freight business on the Great Lakes, and that package freight business could to a large extent be counted on for the Champlain route.

(8) "Other things being equal it is obvious that tonnage will always be attracted to those forms of transportation which offer the greatest economy."

(9) Water transportation was equated to rail transportation as three miles to one mile. If rates were substantially under, or even slightly under, rates now in effect between Great Lakes and Atlantic seaboard points, traffic would move that way.

(10) The New York State barge canal was ineffective, not because it was a canal but because it could only accommodate small craft of shallow draft, and also because there were some 129 low fixed bridges built over it.
(11) A deep waterway by the Champlain route would stimulate industry and be of material advantage to interests on both sides of the boundary, such as lumber and coal, pulpwood, sulphite and paper, marble, slate, Portland cement, oil distributing agencies, fruit and vegetables, etc.
(12) One hundred thousand tons of titaniferous ore were annually brought into the United States from Scandinavia, although there were between 100,000,000 and 200,000,000 tons available in mines west of Lake Champlain, waiting only for cheap transportation.
(13) Refrigeration had become an important factor on the Great Lakes in the shipment of dairy products, and would be equally important in bringing traffic to the Champlain waterway.
(14) The development of the proposed route would benefit recreational interests around Lake Champlain.

Case for Opponents

The case for the opponents embraced, among others, the following points:—

(1) There had been an increase in domestic trade to and from the Atlantic seaboard of the United States, but it was not of a nature, for the most part, to help the Champlain route; anthracite and petroleum, for instance, represented a large tonnage that would not travel that way in any event.
(2) Trans-Atlantic steamship rates were controlled by conferences and their stability was easily upset. Stability could not be maintained if it became practicable for European tramp steamers to go up into the Great Lakes.
(3) Railways of both the United States and Canada were going through a very difficult time. If competition of waterways should be added to that of highways, the railways would be either forced out of business or at least their efficiency and purchasing power impaired. Reduce their purchasing power and you injured the community.
(4) The proposed water route would, if successful, be disastrous to a large body of railway employees.
(5) Railway facilities were more than adequate to handle all available and prospective tonnage. It was not in the public interest to multiply facilities beyond traffic requirements, and in any event there was already a water route in operation from the Great Lakes to tidewater by way of the New York State Barge canal.
(6) The project was commercially and economically unsound because it involved the provision by the Government of a free right-of-way, whereas the railways had to spend millions of dollars on theirs. There was no justification for subsidized transportation.
(7) The State of New York already had 8,000 miles of railway and 47,000 miles of highway, as well as 525 miles of Barge canal. One of the most efficient and best-equipped transportation systems in the world, it represented an enormous investment of capital.
(8) Some witnesses who opposed a deep waterway thought there might be justification for the deepening of the Richelieu River and canals to give a minimum depth of 12 feet between the St. Lawrence and the Hudson.

(9) Opening of a deep waterway from the sea to the Great Lakes would bring into the Middle West the competition of agricultural products grown by cheap labour overseas; also iron ore to compete with the products of American mines, and foreign coal to displace native coal.
(10) The economic picture had radically changed since the International Joint Commission reported in favour of the St. Lawrence waterway in December, 1921. At that time the principal factor was shipment of export wheat. To-day that was no longer an important consideration. At that time railway equipment and terminal facilities on American railways were admittedly inadequate. That was no longer the case.
(11) Even if the waterway were successful, it would not help Vermont and New York interests along the route because the traffic would be mainly through traffic.
(12) It would seriously damage recreational interests around Lake Champlain.
(13) The waterway would necessarily be out of operation five months in the year, and if successful would throw a heavy burden on the railroads during their least profitable season. They would have to provide equipment in winter not needed in the summer.
(14) The cost would fall upon the taxpayers of both countries and could not possibly be justified as a national or international investment.
(15) The very slight existing traffic over the waterway made it highly improbable that it would be profitable to deepen it. The history of the route showed an almost continuous decline in traffic.
(16) Waterways were only justified, in such a region as that under consideration, when rail and water facilities could be co-ordinated so that neither would cripple or destroy the other. That was not the present case. The proposed waterway would simply duplicate existing efficient rail facilities.
(17) The only types of canals that had proved successful were the artificial straits such as the Suez and the Panama canals, the shallow barge canals such as those of France, Germany and the Netherlands, and ship canals like the St. Lawrence channel and the Manchester ship canal. The present proposal did not fall strictly within any of these classes.
(18) All-water services between the Great Lakes and the Atlantic seaboard had already been tried and had proved a failure. There was no real demand for such a service.
(19) What was needed and desired to-day was not an additional means of transportation, but rather the most efficient use of the available facilities at the lowest possible cost to the public.
(20) It was not practicable for deep draft ocean vessels to use such restricted channels.
(21) The business interests of New England were strongly opposed to the project.
(22) The principal requirement on the Atlantic seaboard was not such slow freight as waterways might afford, but rather fast service for manufactured products.

Independent Testimony

Independent testimony on many of the points raised by both the proponents and the opponents is found in the Engineers' Report, filed as an Appendix to this Report.

On the above-mentioned testimony and arguments, as well as on the Report of the Engineers, the Commission bases its Conclusions and Recommendations.

II

CONCLUSIONS AND RECOMMENDATIONS

The authority of the International Joint Commission to investigate the advisability of the improvement of a waterway from Montreal through Lake Champlain to the Hudson River is contained in a letter addressed to the Commission by the Secretary of State of the United States, dated January 2, 1936, and concurred in by the Government of Canada in a letter to the Commission from the Secretary of State for External Affairs, dated February 7, 1936.

Terms of Reference

The letter from the Secretary of State of the United States quotes the following request, embodied in the Act of Congress authorizing the construction, repair and preservation of certain public works on rivers and harbors, approved August 30, 1935:—

> "That the International Joint Commission created by the treaty between the United States and Great Britain relating to boundary waters between the United States and Canada, signed at Washington, January 11, 1909, under the provisions of article 9 of said treaty, is requested to investigate the advisability of the improvement of a waterway from Montreal through Lake Champlain to connect with the Hudson River, together with the estimated cost thereof, and to report to the Dominion of Canada and to the Congress of the United States, with its recommendations for co-operation by the United States with the Dominion of Canada in the improvement of said river."

In transmitting this resolution of Congress to the Commission, the Secretary of State of the United States requested that the "Commission treat the question defined by section 4 of the Act of Congress of August 30, 1935, as being referred to the Commission by the United States under Article 9 of the convention of January 11, 1909, between the United States and Great Britain, for investigation, report and recommendations."

The Commission assumes that in using the word "river" in its resolution Congress intends the word to be used as synonymous with "waterway" and that, as stated earlier in the resolution, the purpose is to "investigate the advisability of the improvement of a waterway from Montreal through Lake Champlain to connect with the Hudson River."

Concurrent Investigations

The Commission notes that by resolution of the Committee on Rivers and Harbors of the House of Representatives of the United States, under date of January 16, 1935, the Board of Engineers for Rivers and Harbors was "requested to review reports of deep waterways between the Great Lakes and the Atlantic tide-waters submitted in House Document No. 149, 56th Congress, second session, with a view to determining the feasibility of constructing a waterway from Saint Francis on the St. Lawrence River to Lake Champlain and thence to the Hudson River at Albany, New York."

The Commission notes further that the Rivers and Harbors Act approved by Congress on August 30, 1935, requested an examination and survey of a "deep waterway to connect Lake St. Francis on the St. Lawrence River with

the Hudson River at Albany by way of Lake Champlain, with a view to determining the feasibility and the cost of such a connection between the St. Lawrence waterway as proposed by treaty and sheltered waters of the Atlantic Coast between Boston, Massachusetts, and Norfolk, Virginia."

The Commission is advised that, because of the close relationship between the last two mentioned requests of Congress—to review reports of deep waterways between the Great Lakes and the Atlantic, and to examine and survey a deep waterway to connect Lake St. Francis on the St. Lawrence with the Hudson at Albany—the Chief of Engineers of the United States Army has given instructions to the District Engineer in New York to prepare and submit a single report embracing both a review and a preliminary examination of the proposed deep waterway from Lake St. Francis by way of Lake Champlain to the Hudson.

Reading the two instructions to the United States Corps of Engineers with the official Reference to the Commission, it appears that all three are directed to the same general end—information that will enable the Governments of the United States and Canada to decide whether or not it is feasible or advisable to co-operate in the construction of a deep waterway between the St. Lawrence and the Hudson by way of Lake Champlain.

Interpretation of Reference

It might be concluded from a study of these several instructions that, while the broad purpose was the same, the intention of Congress was that the Commission and the Corps of Engineers should deal with the matter from somewhat different angles. The latter are requested to survey an overland route for a canal from Lake St. Francis to Lake Champlain and the deepening of the existing water route from there to the Hudson, and also to review the previous Report of the Board of Engineers on Deep Waterways, 1900, which included the same route from Lake St. Francis to Lake Champlain, together with several alternative overland routes. The Reference, on the other hand, requests the Commission to investigate the "improvement of a waterway from Montreal through Lake Champlain to connect with the Hudson River." There is only one existing waterway that can be improved, and that is the route from Montreal down the St. Lawrence to Sorel, up the Richelieu to Lake Champlain, and through the Champlain Canal to the Hudson.

It may be further observed that, while the Corps of Engineers was requested to "determine the feasibility" of a route, the Commission was asked to "investigate the advisability of a waterway". In other words, it would appear that the Engineers were to say if a certain overland route was practicable from an engineering standpoint, while the Commission was to decide if it was advisable to improve or deepen the existing waterway from Montreal via the St. Lawrence River, Richelieu River, Lake Champlain, and Champlain canal to the Hudson, so as to create a deep waterway from Montreal to New York.

After mature deliberation, however, the Commission came to the conclusion that, in order to enable it to give a reasoned answer to the request of Congress and of the Governments of the United States and Canada, it would be necessary to put a broad interpretation upon the terms of the Reference. It decided, therefore, to consider the economic practicability of all the routes, both overland and all-water, that have been proposed and investigated from time to time, not only for a 27-foot channel but also for depths of 14 feet and 12 feet, and thereafter to report which, if any, of these could be recommended for improvement by the co-operation of the United States and Canada.

Instructions to Engineers

To this end the Commission instructed the Engineers, designated by the two Governments to assist it in its investigation, to prepare a report including estimates of the cost of a 27-foot channel on all the proposed routes between the St. Lawrence River and the Hudson, and also estimates of the cost of a 14-foot channel and a 12-foot channel on whatever route should be considered the most economical.

St. Lawrence Waterway Investigation

A point that appeared to call for consideration was the relationship between the proposed deep waterway from the St. Lawrence to the Hudson, and the earlier proposal of a deep waterway from the Great Lakes to the Atlantic by way of the St Lawrence. It will be observed that in the instructions to the Corps of Engineers the route from Lake St. Francis via Lake Champlain to the Hudson is described as "a connection between the St. Lawrence waterway as proposed by treaty and sheltered waters of the Atlantic Coast". Evidently the Champlain route is considered here as a sheltered waterway from the Great Lakes to the sheltered waters between Boston and Norfolk, in alternative to the voyage from the St. Lawrence out into the open sea and thence to Atlantic ports.

The same considerations seem to have impressed themselves upon the minds of those who have been studying the question. At the public hearings held by the Commission in connection with this investigation, there appeared to be a consensus of opinion that, whatever might be the merits or demerits of the project otherwise, it was not practicable from an economic point of view to consider it except as an offshoot of the St. Lawrence deep waterway. Also, those who spoke in support of the Champlain route repeatedly emphasized the value of such a sheltered waterway over the round-about route to the Atlantic seaboard of the United States by way of the Gulf of St. Lawrence and the open sea.

Commission's Conclusions

Directing itself therefore, to the questions: Is it advisable to improve a waterway from Montreal through Lake Champlain to connect with the Hudson River; and what is the estimated cost of such a waterway; the Commission finds:

(1) That there are five possible routes for a waterway from Montreal to the Hudson River by way of Lake Champlain, the last-mentioned being an all-water route and the remainder overland routes, as follows:

(*a*) From Lake St. Francis on the St. Lawrence River to Lake Champlain via the Chazy River.

(*b*) From Lake St. Francis to the Richelieu River three miles south of the City of St. Johns.

(*c*) From Caughnawaga, on the St. Lawrence River, to Fryer's Island on the Richelieu River.

(*d*) From the St. Lawrence at Longueuil to Fryer's Island on the Richelieu River.

(*e*) From the St. Lawrence River at Sorel up the Richelieu River to Lake Champlain.

In the case of all five routes the existing waterway would be followed through Lake Champlain and by way of the Champlain canal to the Hudson River at Albany.

(2) That of these five routes, the last-mentioned (*e*) is the most practicable from an engineering standpoint and the least impracticable from an economic point of view.

(3) That the estimated capital cost and annual carrying charges for the construction of a 12-foot waterway from the St. Lawrence to the Hudson via Lake Champlain would be approximately $12,884,000 and $953,000 respectively; that the estimated capital cost and annual carrying charges for the construction of a 14-foot waterway would be approximately $50,006,000 and $2,738,600 respectively; and that the estimated capital cost and annual carrying charges for the construction of a 27-foot waterway would be approximately $342,205,000 and $17,646,400 respectively.

The Commission has given very careful consideration to the evidence and arguments of those who appeared for or against the proposed waterway, as well as to the Report of the Engineers, but finds nothing that would justify it, at the present time, in recommending the improvement of the all-water route from Montreal to the Hudson River by way of the St. Lawrence River, the Richelieu River, and Lake Champlain, to 27 feet, to 14 feet, or to 12 feet.

The Commission is impressed by the contrast between the maximum potential annual saving in transportation costs, as estimated by the Engineers, and the annual carrying charges mentioned in (3). For a 27-foot waterway, the maximum potential annual saving in transportation costs is estimated to be $4,710,240, as against estimated annual carrying charges of $17,646,400. For a 14-foot waterway, the figures are $75,600 saving and $2,738,600 carrying charges. For a 12-foot waterway the corresponding figures are $58,800 and $953,000.

If these figures were even approximately correct, the United States and Canada would be paying each year on account of the Champlain waterway, if it were a 27-foot channel, nearly four times the amount saved in transportation costs; if it were a 14-foot channel, thirty-six times the saving; and if it were a 12-foot channel, sixteen times the saving.

At the same time it must be borne in mind that estimates of this kind, based on assumptions that may or may not be confirmed by the experience of the future, are very problematical. It is obviously impossible to foresee at the present time what effect the completion and operation of the St. Lawrence waterway might have on tonnage that would be attracted to the proposed Champlain waterway, or on the cost of transporting that tonnage.

It is pertinent to note that, according to statements made to the Commission, the Government of Canada may decide to deepen the Richelieu River to 12 feet throughout its length from the international boundary down to the St. Lawrence. If that should be done, it would only be necessary for the Government of the United States to carry out dredging in certain limited portions of Lake Champlain in order to ensure a 12-foot waterway from the St. Lawrence to the Hudson by this route.

After careful consideration of the evidence adduced at the hearings, the arguments of those who appeared in support of or in opposition to the proposed improvement, the detailed report of the Engineers appointed to assist the Commission, and the briefs and exhibits filed, the Commission begs to report that, with the possible exception of the situation indicated in the preceding paragraph as to a 12-foot waterway, it is neither advisable nor economically practicable to improve a waterway from Montreal by way of the St. Lawrence and Richelieu Rivers through Lake Champlain to connect with the Hudson River, at the present time, and the question as to whether or not it might be desirable to do so at some future time cannot be determined unless or until the proposed St. Lawrence Waterway shall have been constructed and put into operation and the effect thereof known. It is consequently unnecessary at the present time to offer any recommendation as to co-operation by the United States with the Dominion of Canada in the improvement of the proposed Champlain waterway.

Recommendations

Taking into consideration the fact already mentioned that neither the Engineers nor any of the interested parties who appeared before the Commission, in support of or in opposition to the proposed waterway, were of the opinion that it could be justified, if at all, except as an extension of or in conection with the St. Lawrence deep waterway, and the fact that the St. Lawrence waterway is not yet assured and in any event could not be completed and put into operation for a number of years; and the further fact that it is impossible to foresee the changes that may take place in transportation in the meantime, or to estimate the bearing the completion of the St. Lawrence waterway might have on the advisability of constructing the improvement now under consideration, the Commission recommends that the present Report be considered an interim report, and that it be authorized to retain jurisdiction over the matter until the St. Lawrence waterway has become an accomplished fact and the Commission has had an opportunity of studying the effect of its operation upon the proposed Champlain waterway.

Dated at the City of Washington, this 4th day of January, 1938.

(Signed) A. O. STANLEY

CHAS. STEWART

JOHN H. BARTLETT

W. H. HEARST

EUGENE LORTON

GEO. W. KYTE

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III

HISTORY OF REGION

From the particular point of view of transportation, the history of the region embraced in the present investigation goes back to the year 1609, when two famous explorers travelled over much of the route of the proposed deep waterway from New York to Montreal. In that year, more than three and a quarter centuries ago, Henry Hudson sailed up the river that bears his name, and Samuel Champlain paddled up the Richelieu from the St. Lawrence to the lake that has been named after him. Almost at the same time Hudson stood near the site of Troy, and Champlain somewhere about Rouses Point, and neither knew anything about the other's achievement.

An Ancient Water Thoroughfare

It may well be that Champlain looked south over the surface of the beautiful lake and wondered what lay beyond, and that Hudson may have heard from the Indians of the existence of the same lake. A few days in a canoe would have brought one to the other. At any rate it is certain that for many generations before the coming of the white man, this was the recognized water thoroughfare between the Hudson valley and the St. Lawrence, in peace and in war, and thereafter it was to become increasingly important as the main route of travel, again in peace and in war, between New England and New France, and afterwards between the United States and British Canada, until war became definitely a thing of the past so far as these two countries were concerned.

This way went Sir William Johnson and Lord Howe, Abercromby and Amherst, Montcalm and Bourlamaque and Dieskau, Carleton and Burgoyne, Montgomery, Benedict Arnold, Benjamin Franklin and Ethan Allen. On this thoroughfare may still be seen such relics of the stormy past as Ticonderoga, Crown Point, Fort William Henry, Fort George, Isle aux Noix, Fort Montgomery, Fort Chambly and the old Fort at Sorel.

Thoughout the early period the only means of transportation between the Hudson and the St. Lawrence by way of Lake Champlain was the canoe. Portages had to be made from the upper waters of the Hudson to Lake Champlain, and also around rapids on the Richelieu River. These were subsequently supplemented by sailing craft. Early in the nineteenth century plans were discussed for a canal from the Hudson to Lake Champlain, and these finally won the approval of the New York State Legislature.

Early Canal Projects on American Side

In 1792 two private companies were organized, one for the purpose of opening a lock navigation from the navigable part of the Hudson River to Lake Ontario, and the other for opening navigation from the Hudson to Lake Champlain. General Philip Schuyler headed the Board of Directors of both companies. Work was carried forward on the westward division from Schenectady to Seneca Falls, and in 1796 boats of 16 tons burden were plying between those points. In 1793 a contract was made for a canal and locks to open navigation by way of Wood Creek to Lake Champlain, but it was not until 1817 that a serious attempt was made to build the Champlain canal. This was completed in 1823, providing navigation from Waterford on the Hudson to Whitehall on Lake Champlain. The canal was 66 miles long, with twenty locks. The prisms were 40 feet wide at the surface, 26 feet wide at the bottom, and 4 feet deep. The locks were 90 feet long and 15 feet wide. The maximum size of boats navigating the locks was something over 78 feet long and 14 feet wide. They had a draft of $3\frac{1}{2}$ feet and with a capacity of 75 tons, although nearly all built in 1825 were of 35 to 45 tons capacity.

Various changes and improvements were suggested or made in the canal from time to time. In 1860 a bottom width of 35 feet and a depth of 5 feet were authorized. In 1870 the New York State Legislature ordered a bottom width of 44 feet and deepening to 7 feet. This was again urged by the State Engineer in 1878, but the improvement was not completed. In 1900 New York State appropriated $200,000 for a complete survey and estimate of a new canal system embracing the Erie, the Champlain and the Oswego Canals, to which the Cayuga and Seneca branches were afterwards added. The Barge Canals, including the Champlain branch, were opened to navigation in 1918, and a few years later were completed to a depth of 12 feet.

The Narrows of Lake Champlain, from Whitehall to Benson Landing, a distance of 13·5 miles, has been under improvement by the United States Government since 1836. A channel has been provided 12 feet deep at low lake level. with a minimum width of 110 feet.

Canadian Canal Projects on the Richelieu

Canada first considered the necessity of providing a navigable route to connect the St. Lawrence River and Lake Champlain in 1812. After the commencement of construction by New York State of the Champlain canal connecting Lake Champlain and the Hudson River in 1817, the Parliament of Lower Canada, in 1818, granted to a company the right to construct a canal to overcome the rapids between Chambly Basin and St. Johns. This company made surveys but due to financial difficulties its charter lapsed, and in 1823, after a Parliamentary investigation, an Act was passed authorizing the construction, under a Commission, of the Chambly Canal with locks 100 by 20 feet, with a depth of 5 feet. It was stipulated, however, that work was not to commence until the completion of the Lachine canal from Montreal to Lake St. Louis, on the St. Lawrence River, then under construction.

The Commission was appointed in 1829 and was instructed to proceed with the construction of the necessary works to provide for navigation from the St. Lawrence River to the international boundary. Construction of the Chambly Canal was started in 1831 and was carried on intermittently until 1843 when this portion of the system was placed in operation. The original project for navigation between Sorel and Chambly Basin was to deepen the river by means of dredging, and work on this project was carried on during 1830-1831 and then abandoned. In 1835 the construction of the lock and dam at St. Ours was decided on and construction of these works was commenced in 1844 and completed in 1849. The lock at St. Ours as then constructed was 200 feet long by 45 feet wide with 7 feet depth of water.

In 1871 the Canal Commission appointed by the Canadian Government in the previous year to report " as to the best means of affording such access to the seaboard as may best be calculated to attract a large and yearly increasing share of the trade of the northwestern portion of North America through Canadian waters," recommended the early enlargement of the Richelieu River canal system to a depth of 9 feet with locks 200 feet long and 45 feet wide. No action was taken on this recommendation.

From 1928 to 1930, the navigation channel in the Richelieu River between Sorel and St. Ours was deepened to 12 feet. In 1930 work was commenced on the construction of a new lock at St. Ours, 339 feet long and 45 feet wide, with a depth of 12 feet over the sills. This lock was completed in 1933.

The construction of a regulating dam in the river between St. Johns and Fryers Island, 8 miles below, has been proposed several times since 1900, both as a means for preventing damages caused to riparian owners by flooding at periods of extreme high water on Lake Champlain and as a means to increase the low-water flow for the purpose of power development. The Canadian Government has appropriated funds to construct a dam designed to accomplish the first-mentioned purpose.

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Deep Waterway Projects on American Side

The practicability of a waterway between the St. Lawrence and the Hudson by way of Lake Champlain has been given serious consideration from time to time, in reports to the United States Government or to the Canadian Government, sometimes as individual projects and sometimes as one of several possible routes. These reports have dealt with either the enlargement of the existing route by way of the Richelieu River, or canals from the St. Lawrence to Lake Champlain or the Richelieu River.

The earliest of the American reports is dated in 1875. In it the proposed Champlain route was from Caughnawaga on the St. Lawrence overland to St. Johns on the Richelieu, thence to Lake Champlain, thence to Woods Creek, thence overland to the Hudson at Fort Edward, and down the Hudson to Albany. The canals on this route were to be 100 feet wide and 13 feet deep and to pass steamers having a capacity of 1,500 tons. The estimated cost for the section from Lake Champlain to Albany was $14,115,893. It was assumed that the portion in Canada would be built and paid for by the Canadian Government.

In 1897 another report was made to the United States Government in which various ship canal routes were discussed, including that by way of the Richelieu River and Lake Champlain.

In 1900 the Board of Engineers on Deep Waterways carried out an elaborate investigation of various routes, among others one from Lake St. Francis overland to deep water in Lake Champlain thence to the Hudson river. The Board reported in favour of a 21-foot chanel by the La Salle-Lewiston and Oswego-Mohawk route, at an estimated cost of $206,358,000.

In 1918 a report was made on the commercial aspect of a ship canal to connect the Great Lakes with the Hudson; and in 1920 a preliminary examination was made of a route for ocean-going vessels, but it was decided to give no further consideration to the matter until completion of the new Welland Canal and actual demonstrations of the adequacy or otherwise of the New York State Barge Canal.

In 1926 consideration was again given to the project of a waterway from the Great Lakes to the Hudson suitable for vessels of 20 or 25 feet draft. Among the routes considered was that from Lake St. Francis to Lake Champlain and the Hudson. It was decided to take no further steps toward the building of a waterway pending further study in connection with the report on the St. Lawrence waterway.

In 1930 the Chief of Engineers of the United States Army submitted a report of the Board of Engineers for Rivers and Harbors reviewing reports heretofore submitted on the Great Lakes-Hudson River waterway.

In 1933 a similar report of the Board of Engineers for Rivers and Harbors was published.

In 1934 hearings were held before the Committee on Rivers and Harbors of the House of Representatives, and published under the title "Great Lakes-Hudson River Waterway."

Canadian Deep Waterway Projects

At the same time similar projects for constructing or improving waterways from the St. Lawrence to the Hudson were being considered on the Canadian side. These proposals date back to the completion of the Welland and St. Lawrence canals to 9 feet in 1847. About that time agitation arose for the building of a canal of similar dimensions to connect the St. Lawrence with Lake Champlain and provide a water route between Canada and the American seaboard. As a result of this agitation, under instructions from the Commissioners of Public Works of Canada, five reports were made on various projects by Messrs. Mills in 1848, Jarvis, in 1855, Gamble, in 1855, Swift in 1855, and Gamble in 1856.

The various projects considered are briefly described as follows:—

(*a*) Enlargement of existing route up Richelieu River entailing deepening of river channels, construction of a new lock at St. Ours, and the enlargement of the Chambly Canal.

(*b*) Canal from Longueuil, opposite Montreal on the St. Lawrence River, to St. Johns on the Richelieu River. Total length of canal—28·5 miles. Rise in lockage from Longueuil to St. Johns—74 feet. Number of locks—6 lift and 1 guard.

(*c*) Champlain level canal from Caughnawaga, 10 miles above Montreal on the St. Lawrence River, to St. Johns. Total length of canal—32·5 miles. Rise in lockage from Caughnawaga to St. Johns—27 feet. Number of locks—2 lift and 1 guard.

(*d*) Summit level canal from Caughnawaga to St. Johns, with a summit level 33 feet above Lake Champlain level, supplied with water through a feeder canal, 16 miles long, from above the sixth lock on the Beauharnois canal. Total length of canal—25·5 miles. Rise in lockage from Caughnawaga to summit—60 feet. Drop in lockage from summit to St. Johns—33 feet. Number of locks—8 lift and 1 guard.

(*e*) Same as (*d*) but with feeder canal from Beauharnois canal made navigable to enable vessels to and from points on Lake St. Francis and above to proceed to Lake Champlain without descending to Lake St. Louis. The connection from Caughnawaga to St. Johns would be the same as in (*d*). The canal from the junction with the Beauharnois canal to St. Johns would be as follows: Total length of canal—37·5 miles. Drop in lockage from Beauharnois canal to St. Johns—34 feet. Number of locks—3 lift.

(*f*) Canal from a point 6 miles above the lower end of Lake St. Francis on the St. Lawrence River to a point 3·5 miles south of St. Johns on the Richelieu River. The country traversed by this canal was considered unfavourable to the construction of a canal. Total length of canal—56 miles. Drop in lockage from Lake St. Francis to the Richelieu River —57 feet.

With the exception of Mr. Jarvis all the engineers mentioned above recommended a canal from Caughnawaga to St. Johns; Mr. Jarvis favoured project (*e*). The depth of canal proposed was 10 feet, with locks 230 feet long and 45 feet wide. Nothing further was done until 1870, when a private company was incorporated to build a canal from Lake St. Louis on the St. Lawrence River to Lake Champlain. The Company's charter was extended from time to time but no work was over done.

In 1895 at the request of the United States Government, Canada appointed three commissioners to act with a similar number appointed by the United States to inquire and report on the feasibility of building a system of canals to open the Great Lakes to ocean-going vessels. The Canadian Commissioners, in their Report of June 17, 1897, described a project for a canal between the lower end of Lake St. Francis and the Richelieu River at St. Johns. The length of this canal was 47 miles, and two lift locks and one guard lock were proposed to overcome the difference in level of 57 feet. A branch canal 3·5 miles long with 3 locks with a combined lift of 84 feet was proposed to provide a connection between Lake St. Louis at Caughnawaga and the main canal. The depth proposed was 28 feet.

In 1898 the Lake Champlain and St. Lawrence Ship Canal Company was incorporated by Act of Parliament, with powers to develop hydraulic power and to construct a canal from the St. Lawrence River in the vicinity of Longueuil to some point on the Chambly canal on the Richelieu River. Their charter was extended from time to time, the last extension being granted in 1911.

In 1906, the International Development Company, assignees of the Lake Champlain and St. Lawrence Ship Canal Company, applied to the International Waterways Commission for permission to construct regulating works in the Richelieu River. The Commission, in a joint report dated November 15, 1906, refused the application of the company and stated that the applicant should furnish conclusive evidence that private rights in the States of Vermont and New York would not be affected by the alteration of lake levels as proposed, and that the works should not be undertaken without the permission of the United States Secretary of War and should be operated under such regulations as he might direct.

In 1911, the above named company submitted plans for approval to the Dominion Government. According to these plans, the company proposed to construct a regulating dam across the river at Hospital Island about 5 miles north of the international boundary, with a lock at this point to pass navigation. Another dam was to be built at Fryers Island, from which point a canal 14 feet deep and 21·5 miles long left the river and crossed the country to the west to enter the St. Lawrence River at Longueuil below Victoria Bridge. Five locks were proposed to overcome the 74-foot difference in water level between the proposed regulated level of the Richelieu River at Fryers Island and the St. Lawrence River at Longueuil. A forebay was to be excavated from the navigation canal to a power house to be located on the shore of the Richelieu river below the upper dam of the Montreal Light, Heat and Power Company. The head available at this site was estimated to be about 26 feet and the minimum power available at 17,500 horsepower. No action was taken by the Government on these plans and the company's charter was allowed to lapse.

The various projects proposed and studied from time to time for a deep waterway between the St. Lawrence River and the Hudson River resolve themselves into five probable routes for that portion of the waterway between the St. Lawrence and Lake Champlain:—

(*a*) From Lake St. Francis overland to Lake Champlain at the mouth of the Big Chazy River, about 6 miles south of the international boundary.

(*b*) From Lake St. Francis overland to the Richelieu River above St. Johns, thence up the Richelieu River to Lake Champlain.

(*c*) From Caughnawaga on Lake St. Louis to the Richelieu River above St. Johns, thence up the Richelieu River to Lake Champlain.

(*d*) From Longueuil on the St. Lawrence River overland to the Richelieu River, thence up the Richelieu River to Lake Champlain.

(*e*) From Sorel on the St. Lawrence River up the Richelieu River to Lake Champlain.

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IV

PUBLIC HEARINGS

Summary of Testimony

NEW YORK

The Commission held its first public hearing in the city of New York from November 19 to 21, 1936.

E. L. Daley

In his opening statement Colonel E. L. Daley of the Corps of Engineers, U. S. Army, who had been designated to assist the Commission in the engineering side of its investigation, pointed out that his office was at the same time engaged upon a somewhat similar examination, in response to the following resolution of the Committee on Rivers and Harbors of the House of Representatives, dated January 16, 1935:

> "Resolved by the Committee on Rivers and Harbors of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors created under Section 3 of the Rivers and Harbors Act, approved June 13, 1902, be, and is hereby, requested to review reports of deep waterways between the Great Lakes and the Atlantic tide waters submitted in House Document No. 149, 56th Congress, Second Session, with a view to determining the feasibility of constructing a waterway from Saint Francis on the St. Lawrence River to Lake Champlain and thence to the Hudson River, at Albany, New York."

Colonel Daley explained that House Document No. 149, referred to in the Resolution, was a report dated June 30, 1900, by a Special Board designated and appointed by the President in conformity with the provisions of the Sundry Civil Act of Congress of June 4, 1897. In accordance with this Act and supplemental acts, the Report included studies of several deep waterway routes between the Great Lakes and the Hudson River. The work of the Board occupied about two years and constituted an actual survey of the routes considered. In addition to making a review of that report, Colonel Daley's office had been requested to make an examination and survey of the following routes:

> "Deep waterways to connect Lake St. Francis on the St. Lawrence River with the Hudson River at Albany by way of Lake Champlain, with a view to determining the feasibility and the cost of such a connection between the St. Lawrence waterway as proposed by treaty, and sheltered waters of the Atlantic coast between Boston, Massachusetts, and Norfolk, Virginia".

Because of the close relationship between these two studies, Colonel Daley said that he had been authorized by the Chief of Engineers to submit a single report to embrace both a review of the matters in the Resolution of the Committee on Rivers and Harbors and a preliminary examination of the last-mentioned item in the Rivers and Harbors Act of August 30, 1935. As these two examinations related to the same general field covered by the Reference to the Commission, the three investigations, would, so far as the Corps of Engineers was concerned, be carried on simultaneously.

Leland Olds

Mr. Leland Olds, an economist on the staff of the New York State Power Authority, testified on behalf of the Champlain Valley Council. He submitted two maps, the first entitled, American Flag Services in Foreign Trade, and the second, Proposed Hudson-Champlain Seaway as a link in United States Intercoastal commerce. (Olds Exhibits 1 and 2).

Mr. Olds made it clear at the outset that the Champlain waterway could only be considered as a branch or alternative outlet for the St. Lawrence deep waterway. His purpose was to give what might be called an economic birds-eye view of the larger project in relation to the proposed Champlain waterway. He submitted a Memorandum on the Economic Aspects of the Hudson-Champlain Seaway Project.
It was filed as Olds Exhibit No. 3.

Interdepartmental Survey.—Mr. Olds filed a report prepared by an Interdepartmental Board for the President of the United States in 1933-34, entitled "Survey of the Great Lakes-St. Lawrence Seaway and Power Project" (Olds Exhibit No. 4). The survey is in four parts as follows:

Part 1. Reports prepared by the War Department as to the engineering and economic advisability of the proposed Great Lakes-St. Lawrence improvement.

Part 2. A report on the Great Lakes-St. Lawrence seaway, dated January 6, 1934, prepared in the Department of Commerce.

Part 3. A report on the Great Lakes-St. Lawrence seaway, dealing with the matter of land and water transportation, with analysis of Interstate Commerce Commission data, furnished by the Interdepartmental Board.

Part 4. A report on the economic advisability of the St. Lawrence power project, prepared by the Federal Power Commission with the co-operation of the Power Authority of the State of New York.

Mr. Olds pointed out that the Federal Power Commission, the U.S. Engineers' Office of the War Department, the Department of Commerce, and the Power Authority of the State of New York, co-operated in the preparation of the Report, with the assistance also of the Interstate Commerce Commission.

Inter-coastal Trade.—Discussing the prospective commerce that might be expected to use the Champlain waterway route, Mr. Olds said:

> "We find that in the Great Lakes—St. Lawrence tributary area, the area that would find an outlet through this proposed seaway, that would find a means of securing its raw materials and other goods imported or brought from other regions of the country through this seaway—we find that in this area we have a total population of something over forty-two million people, which compares with a population of approximately fifty million people in the Atlantic coastal area. In other words, simply in terms of the Atlantic coast in relation to what would become the Great Lakes coast if this seaway were opened, we have a relationship established between approximately forty-two million people living in the Great Lakes tributary area and approximately fifty million people living in the Atlantic coastal area. This is an important economic fact, because those vast populations are both producers and consumers, and to a very considerable extent in our highly integrated economic order, they are purchasers and consumers of each other's products; there is a flow back and forth from one region to the other wherever you have a producing and a consuming population of great magnitude. Now, this proposed Lake Champlain-Hudson river

route affords a direct natural connection for cargo vessels moving in inter-coastal trade between this Great Lakes area and this Atlantic seaboard area."

Resources of Inter-coastal areas.—"We can measure in another way the importance of this inter-relationship that will be established—in terms of the value of manufactures in the two areas. In the Great Lakes—St. Lawrence area the 1929 value of manufacture was approximately $28,000,000,000. In other words, we are bringing into a movement of freight through large cargo vessels that need not break cargo, a region with approximately $28,000,000,000 of manufactures in normal periods, and that is being tied in with the Atlantic area which has a manufacturing output of approximately $33,000,000,000. Of raw materials in the two areas there are approximately $16,000,000,000 in the Great Lakes, and $17,000,000,000 in the Atlantic area. This cut-off we are discussing to-day would connect not only the Atlantic area but also the Gulf area. The Gulf area has a population of approximately twenty million people, and a manufacturing output of something over $4,300,000,000, with about $2,685,000,000 in raw materials required for that manufacture. Finally, the Pacific coastal area has a population, which will also be brought into direct low-cost connection with the Great Lakes area, of approximately ten million, and a manufacturing output of approximately $5,000,000,000. I am bringing this out at this point simply to indicate the basis upon which I have estimated the inter-coastal commerce that can be immediately expected to flow via this proposed Lake Champlain-Hudson river route."

Panama Canal.—"We have in the Panama Canal a somewhat similar economic picture. The Panama Canal not only serves an important purpose in terms of foreign commerce, but also affords an important means for low cost transportation between the Atlantic and Gulf areas, and the Pacific coast area. Actually over a period of several years prior to the depression, approximately 10,000,000 tons of freight moved in inter-coastal trade through the Panama canal. Now, the estimates I am using here for inter-coastal trade which may be immediately expected to flow through this Champlain-Hudson route are based on a comparison between the freight that is now flowing through the Panama canal between these various economic regions, and the relative importance of the inter-connection in terms of the economic factors I have just mentioned when we make it possible for cargo vessels to move as easily into the Great Lakes area as they to-day move by way of the Panama canal from the Atlantic seaboard to the Pacific seaboard. On that basis, rough approximations would show inter-coastal trade flowing into the Great Lakes through this Champlain-Hudson cut-off in the amount of approximately 3,600,000 tons, and an inter-coastal trade outbound from the Great Lakes area of approximately 2,400,000 tons.

"Altogether, on the basis of these estimates, including both foreign and inter-coastal trade, and both ingoing and outgoing traffic, my estimate is that the Hudson-Champlain route would have very early in its history after its completion available approximately 12,000,000 tons of traffic."

Foreign Commerce.—Mr. Olds estimated the foreign commerce that would use the St. Lawrence waterway as amounting to 5,742,000 tons imports into the Great Lakes area, representing a saving of approximately $5.56 a ton, or a total of $34,000,000, and 7,471,000 tons exports, representing a saving of $7.02 per ton, or a total of $44,810,000. On the basis of estimates for inter-coastal commerce by the St. Lawrence waterway, it was found that the approximate figures would be 3,600,000 tons at $3.94 a ton, or $14,180,000 inbound, and 2,400,000 tons at $3.94 a ton, or $9,456,000 outbound.

Savings by Water Route.—Mr. Olds maintained that in addition to the estimated savings by the St. Lawrence route between the Great Lakes and the sea, there would be additional savings not only in foreign trade but also in inter-coastal trade, if the Champlain cut-off were used. In terms of foreign trade, this additional saving would, based on approximately 1512 vessel transits at a saving of $1,820 per transit, amount to about $2,752,000. In inter-coastal trade, on the basis of 1,400 vessel transits, with a saving of $1,820, there would be an additional saving of $2,548,000. Mr. Olds added: "So that roughly, taking all these figures into consideration, I think it is a fair estimate that the entire Great Lakes-St. Lawrence seaway project, including this Champlain cut-off, will mean a saving closely approximating $100,000,000 a year in the cost of transportation."

Creation of New Traffic.—After discussing the effect the opening of the Panama canal had on commerce between the Atlantic and Pacific coasts of North America, Mr. Olds emphasized the fact that while a certain amount of heavy bulk shipments that formerly moved by rail now went by water through the canal, the railways were actually benefited because they were carrying a considerably larger percentage of traffic that pays the highest freight rates, and the canal, because of the cheaper cost of water transportation, was carrying traffic which would never have flowed between the Atlantic and the Pacific if there had not been this cheap water route. He argued that the same thing would happen if the Champlain route were opened—that in fact much of the traffic by that route would not be taken from the railways but would be new traffic created by cheaper transportation facilities.

Potentialities of Route.—Concluding an analysis of the data contained in the "Survey of the Great Lakes-St. Lawrence Seaway and Power Project" (Olds Exhibit No. 4), Mr. Olds said:—

> "In closing what I have to say, I would like simply to re-emphasize one point and that is that in weighing the importance of a waterway project such as that which is before the Commission to-day we are dealing primarily with a connection between economic areas, between regions of economic importance, in terms of agriculture, in terms of mining, in terms of industry, on the one hand, treating them as producing regions; in terms of consumption—consumption of raw materials, consumption of non-consumer goods, on the other hand; and if we can look at the problem with imagination we will see that figures such as are presented in most reports represent simply the stepping stones to a conception of this waterway, not to-day, not ten years from now, but in terms of what it will mean in the life of the country twenty or thirty years from now, a life which it itself has helped to create and expand.
>
> "In other words, the figures that were compiled by the Department of Commerce in Document No. 116, whereas they actually show nothing specific or directly about traffic; whereas they say nothing about tons of steel or tons of wood or tons of rubber or tons of automobiles moving, actually they show that underlying such a project as this there are dynamic potentialities which mean that once you create an interconnection that demonstrably means lower transportation costs, you have created an agency which will build its own commerce rather than take commerce away from other agencies, and in doing so will build up the economic regions of the Great Lakes area, the Atlantic area and the Pacific area, which it will serve as low cost interconnection."

Champlain Route linked with St. Lawrence Waterway.—During the cross-examination of Mr. Olds, Mr. Keiser made a statement which it is important to

put on record because it apparently represented the views of all interests at the hearing which supported the project. Mr. Olds had said:—

> "I consider the thing as economically important as an extension of the Great Lakes-St. Lawrence seaway, not as a separate waterway project." Mr. Keiser commented, "I may add that that is the contention of the Champlain Valley Council, and, as far as I know, of most of the proponents of this project, that it is economically sound in conjunction with the St. Lawrence development, and is not economically sound otherwise." Opponents of the project were in agreement with the proponents to the extent that they all believed the Champlain waterway could not be seriously considered as an independent project.

Robert R. Dunn

Mr. Dunn of the Great Lakes-St. Lawrence Tidewater Association spoke in support of the St. Lawrence Deep waterway.

F. S. Keiser

Mr. Keiser, Traffic Commissioner of the Duluth Chamber of Commerce, appeared on behalf of the Champlain Valley Council and made a direct statement on behalf of that organization. He filed Keiser Exhibits 1 to 17 inclusive and commented upon the evidence they contained.

His Exhibit 1 consisted of a map showing the proposed deep waterway from the St. Lawrence via Lake Champlain to the Hudson. Mr. Keiser said that the plan most generally approved by the people he represented would be canalization from a point six miles east of Montreal to the Richelieu River, the development of the Richelieu River into Lake Champlain, the deepening of the necessary ports on Lake Champlain, the deepening of the channel between the Hudson River and Lake Champlain, so as to furnish a draft of 30 feet along the entire route. "From a traffic standpoint" he said, "the distance from Montreal to New York by this route is 375 statute miles, and the distance around through the St. Lawrence from Montreal to New York is about 1,680 miles, so the actual saving in distance contemplated in this development, in round figures, is 1,300 miles." He continued, "It is approximately the same whether you use any of these routes."

Deep Channels Essential.—On the question of deep draft navigation, Mr. Keiser said: "Let me state that the only water transportation that is really cheap is water transportation that recognizes deep draft. When you have shallow draft, contemplating as it does a transfer of lading generally twice en route, contemplating further as it does restricted navigation, you have absolutely killed the very reason for the existence of water transportation."

Asked by the Chairman as to what he meant by shallow draft and deep draft, Mr. Keiser replied: "I should say that when you get 20 feet and over you begin to get into economical transportation. I mean as compared with other classes of transportation. But ordinarily water transportation has many handicaps, so that at even rates it would never be used as compared with rail transportation. It is only because it is cheap that it is used, because it is obvious that it takes longer to haul it. It requires certain classes of traffic that could be handled only by water. Unless water affords comprehensive savings under competing modes of transportation, it will never be used. That is the outstanding reason why a 12-foot draft in New York State has never been a success. It is the reason why, as I see it, the Mississippi River has never been a success. I mean, success that you naturally expect to follow the development of water transportation.

"The minute you begin to get into shallow draft, you begin to get into an expensive proposition that does not pay you to handle your freight that way, and therefore shallow draft propositions do not pay for themselves because they do not attract traffic."

Asked if he considered anything under a 20-foot draft as shallow, Mr. Keiser said: "Yes, out on our lakes we have about a 20-foot draft, and there is a tremendous tonnage on the lakes, but I do not know of any other shallow-draft proposition, although I have not made a careful study of it in all the sections of the country, that has ever been what I call a paying water proposition."

Mr. Keiser filed his Exhibit 2, containing statements showing the saving in distance by the use of the Champlain cut-off from representative points in the Great Lakes area and Atlantic seaboard points; showing estimated rates applicable via St. Lawrence and via cut-off, all-water between Chicago, Duluth and Portland, Me., Boston, Providence and New York; of current rail rates; of current lake and rail rates; and comparison of average current rates, all rail and rail-lake, with estimated St. Lawrence and cut-off rates on package freight between Chicago, Duluth and Atlantic seaboard points.

Importance of Inter-Coastal Traffic.—Discussing this Exhibit, Mr. Keiser held that the great value of the St. Lawrence waterway and the Champlain cut-off was not in the prospective export and import traffic, but rather in the coastwise and inter-coastal traffic. His figures showed that the percentage between these two classes of traffic was about 90 per cent coastwise and inter-coastal and ten per cent export and import. He admitted that that was not a normal condition, and that possibly if export business came back it would represent a larger proportion, but he did not believe that at any time within the last twenty-five years had the export and import traffic of the United States amounted to as much as twenty-five per cent of the coastwise and inter-coastal trade.

Mr. Keiser explained that all figures in his exhibits related to United States traffic as he had not been able to get the Canadian figures.

Narrow Margin of Profit.—Mr. Keiser filed his Exhibit No. 3, which contains a statistical report of lake commerce through the canals at Sault Ste. Marie, American and Canadian, for the ten-year period from 1926 to 1935 inclusive. He said that the figures, which covered only Lake Superior tonnage, were offered merely to suggest what deep draft navigation on all the Great Lakes, with reasonable freight rates, would mean in terms of tonnage. "It is axiomatic," he said, "and this is particularly true of later years, that business is not handled as it used to be; it is handled on a narrower margin of profit, to such an extent that the manufacturer or distributor is forced to use the cheapest possible mode of transportation in order to live. I say without any qualification at all that if this canal is built, there will be no question as to plenty of tonnage being available; one lake would support it, when there are three or four to support it."

Mr. Keiser's Exhibit No. 4 contains a statement of freight passing through the locks at Sault Ste. Marie, 1926 to 1935 inclusive.

His Exhibit No. 5 purports to show the present sea coast of the United States and the additional mileage that would be added if the St. Lawrence waterway and the Champlain cut-off were built.

Mr. Keiser's Exhibit No. 6 shows the number of passages, the freight carried and the average freight per vessel moving through the St. Mary's River for the years 1910 to 1932, both inclusive.

Tonnage Statements.—The purpose of Exhibit No. 7 was to show the comprehensive nature of the movement of commodities such as asphalt, cement, coal and coke, grain and flour, that moved heavily over the Great Lakes water routes.

In Keiser Exhibit No. 8 is shown the tonnage that is moving through Atlantic coast, Gulf coast, Pacific coast and Great Lakes ports, imports and exports, as well as domestic traffic of the United States. Mr. Keiser drew attention to the point that whereas the imports amounted to only 35,000,000 tons and the exports to 43,000,000 tons, the domestic traffic represented 281,000,000 tons. These statistics related to the United States alone and did not include Canada.

In filing his Exhibit No. 9, Mr. Keiser pointed out that it showed over a period of years a comparison of the tonnage moved in foreign traffic and domestic traffic, on the Atlantic, Gulf and Pacific coasts, also foreign and domestic (United States) traffic on the Great Lakes.

In his Exhibit No. 10, Mr. Keiser presented a statement comparing foreign with coastwise tonnage at the ports of Portland, Me., Boston, Providence, New Haven and Bridgeport. "You will see," he said, "that the relationship of foreign tonnage to domestic tonnage or coastwise tonnage is as 8·41 to 100."

Frank S. Davis

Commenting upon Exhibit No. 10, Mr. Davis, Manager of the Maritime Association of the Boston Chamber of Commerce, said:—

> "The witness presents a statement that shows a surprising increase in the volume of domestic traffic. That is true; it has increased, but the increase is not in commodities that concern him in the western part of the country, or that would move down through this waterway. Anthracite coal would not move from eastern Pennsylvania around through the Great Lakes and through the St. Lawrence and back into New England. Anthracite coal would move by the Atlantic coast routes. Petroleum from Texas would not come up the Mississippi, through the Great Lakes, and down the Hudson River. It would traverse the natural routes over which petroleum is bound to move from Texas and the mid-continent field."

F. S. Keiser

Replying to a comment of the Chairman, Mr. Keiser said:—

> "There are two factors in water transportation: one is bulk freight and the other is package freight. I have not dealt as yet with estimates or rates with regard to bulk freight which Mr. Davis talks about; I have simply given you a picture of the savings that would be contemplated on package freight, high-grade freight, and as far as these tonnage figures are concerned, I have made a clear-cut presentation as to what they are according to government reports. . . . I do not care what the commodity is, whether it is a bulk commodity or a package commodity; it will move on this route if the savings are there to justify it."

Exhibit No. 11 shows export shipments of all kinds of grain from Duluth through Canadian and American ports for the years 1920 to 1935 inclusive.

Refrigeration.—Exhibit No. 12 shows the movement of package freight from Duluth to Buffalo in the first nine months of 1936 and the estimated per cent and tonnage of such traffic that would be available for the Champlain cut-off. This package freight at present moved by water and rail routes. Mr. Keiser informed the Commission that in 1914 three boats operating out of Duluth were equipped experimentally with refrigeration so that they could handle dairy products. That service went into effect in the spring of 1916. Since that time the shipment of

dairy products out of Duluth by one boat had jumped from nothing to 69,000 tons per annum. "Every package boat that serves Duluth is now equipped with refrigerator boxes, and that is the most intensive service we have."

Rail Freight Rates Increase.—Discussing the increase in freight rates on railways, Mr. Keiser said:—

> "There is a saturation point in freight rates that you cannot go beyond with impunity. You can go so far beyond that you choke off distribution. In other words, constantly raising freight rates isolates communities one from another. It drives long-haul transportation to short-haul transportation and thence to trucks. Why the rail carriers do not see that is inconceivable to me. I think some of them do see it, but in so far as we have been able to see, there has been a constant up-trend in rates."
>
> "We have long since reached this saturation point in this country. From the middle west we have got our raw products in and finished products out on a more reasonable transportation charge; and that is exactly why we came to you ten or twelve years ago on the St. Lawrence project, and why I am here to-day asking you to ratify this plan."

Exhibit No. 13 shows the population, area per square mile, number of counties in New England and their population per square mile, bordering on the Atlantic, compared with the same information in New England counties not so located. This Exhibit is designed to show the importance of deep water navigation.

Wheat Rates.—Keiser Exhibit No. 14 gives the rates on wheat (domestic) through Buffalo to New York from 1889 to 1936 inclusive. It gives the rates in cents per hundred pounds for the rail haul east of Buffalo. These rates vary from 7·5 to 22·67, in 1892 and 1921. Mr. Keiser added that as contrasted with these figures, grain was handled on the lakes for as little as 2 cents per bushel, and he had known it to be as low as one cent per bushel.

Canal Traffic.—Keiser Exhibit No. 15 compares the tonnage carried during the past seventeen years on Canadian St. Lawrence canals and the New York State Barge canal. The purpose of the Exhibit, as explained by Mr. Keiser, was to show that shallow draft navigation does not attract business.

Keiser Exhibit No. 16 consists of a statement taken from the Report of Public Works of the State of New York, showing the tonnage and commodities moving over the Barge canal, 1926 to 1935 inclusive.

Keiser Exhibit No. 17 shows the trade and tonnage on the various canals in the State of New York, 1926 to 1935 inclusive.

Effect of Panama Canal on Railroads.—Discussing the effect of the Panama Canal upon the western railroads, Mr. Keiser said:—

> "There was a total tonnage of 4,882,455 tons passed through the Panama canal in 1915. In 1929 that tonnage was 30,663,006. There is a period of fifteen years.
>
> "During the same period of 1915—I speak now of the western railroads that would compete with the Panama canal—their tonnage was 449,329,900 tons. In 1929 that had increased to 727,098,787 tons.
>
> "In other words, the traffic through the Panama canal actually gained during that period 25,774,552 tons, and during the same period with these competing railroads there the tonnage gained in actual tonnage just eleven times, or almost eleven times that amount, or in the neighborhood of 277,000,000 tons.

"That would seem to indicate that there is at least food for thought in the idea that the opening up of any deep water project builds the country to such an extent as to offer a compensating traffic to any that might be diverted."

Cornelius H. Callaghan

Mr. Callaghan, Maritime Association of the Port of New York, commenting on Mr. Keiser's testimony said:—

"Mr. Keiser has stated that the Port of New York would benefit. We all understand that these steamship services from New York and North Atlantic and Gulf ports have been built up after many years of severe struggle, and it is necessary that there be stability of rates. They are all controlled by conferences, and the stability of rates is a very tender thing; it takes little to upset or demoralize it. If this cut-off is made, and it is all predicated upon the canalization of the St. Lawrence, and the tramp ships of Europe and the world go up the St. Lawrence carrying this freight, it will be utterly impossible to maintain stability of rates on our steamship lines, our American merchant marine, from the Atlantic seaboard to the Gulf, and the other ports of the world."

F. F. Estes

Mr. Estes, representing the National Coal Association of Washington, D.C., stated that this Association represented in turn the soft coal producers of the United States. He asked and was given permission to file a brief.

R. A. Schaff

Mr. Schaff appeared on behalf of the New England Association of the Brotherhood of Locomotive Engineers. He testified that at a meeting in Hartford on October 17 and 18 the Association voted in opposition to the proposed Champlain waterway. "It will," he said, "eliminate engineers, firemen, brakemen, conductors, car men and everybody else working on the railroads. . . . . We are opposed to the canal for the simple reason that the public pays the bill."

Fred N. Oliver

Mr. Oliver entered appearances for himself and Karl K. Michelet, as representing the Railroad Security Owners Association. He asked for and was given permission to file a written statement.

Murray K. Hart

Mr. Hart appeared on behalf of the New York State Economic Council, and asked for and was given permission to file a brief against the proposed waterway.

Clare B. Tefft

Mr. Tefft, Traffic Director of the Toledo Chamber of Commerce, testified on behalf of the proponents. "It might be said at the outset that it is exceedingly difficult to secure an absolute break down of rail tonnage between Toledo and eastern points, because such a break down of tonnage is only available in the records of the several railroads serving the involved territory. In the case of water-borne commerce it is not so difficult. During the year 1935, by referring to the U. S. Army Engineers' Report for the Great Lakes district on tonnage, we find 206,000 tons of water-borne commerce which could in every instance have used the projected Lake Champlain canal as an alternative route. That of course was actual movement, but it is altogether likely that with a

sufficient depth to permit the operation of vessels with a greater draft, a market might be developed, for example, for bituminous coal from the Ohio and Inner and Outer Crescent fields.

"To those who are not familiar with the coal fields, I might say that the Crescent fields are just outside the coal fields in Ohio and West Virginia. That territory lying adjacent to Ohio and the Outer Crescent fields is stripped just beyond the Inner Crescent fields."

Cheap Water Routes.—"Having some knowledge of the flow of rail traffic, it is safe to say that in 1935 approximately one and a half million tons of freight moved between Toledo and the territory in the east which would be served directly or indirectly via the proposed Lake Champlain route. It is difficult to make predictions as to the tonnage which might be developed for such a route, although there are certain factors present in our transportation picture which might tend to bring favorable reactions toward such a route. It is generally admitted that one of the major problems of to-day is that of distribution, and, of course, the factor of transportation is predominant in this problem. All other things being equal it is obvious that tonnage will always be attracted to those forms of transportation which offer the greatest economy.

"It has always been an accepted fact that the cheapest mode of transportation is over natural highways. In considering, however, the cost of moving commerce over an artificial waterway, there must be balanced against the initial cost and maintenance of such projects, the savings which may thereby be made in transportation costs. If these effected savings will in any given normal period of years liquidate such initial and attendant annual maintenance cost, then it would seem to us there can be no question as to its justification."

Leonard Simms

Mr. Simms, Manager of the Transportation Department of the Detroit Board of Commerce, testified on behalf of the proponents. He filed five exhibits, the first showing tonnage and value of commerce passing through the Detroit River, the second, freight tonnage through the Sault Ste. Marie Canals, the third, freight tonnage through the New York State Barge Canal system, these three all for the years 1925 to 1935 inclusive; the fourth showing new car registrations (automobiles) in 1935 and 1936 in Connecticut, Maine, Massachusetts, New Hampshire, part of New Jersey, part of New York State, Rhode Island and Vermont; and last, a statement showing expenditures by the United States Government on the improvement of eight Great Lakes ports.

Great Lakes Traffic.—Mr. Simms commented upon these exhibits, the figures of which are assumed to support Mr. Tefft's statement. Mr. Simms brought out the facts that in the peak year 1929, over 110,700,000 tons of traffic passed through the Detroit River, the value of which was $1,195,700,000. In 1935 the tonnage amounted to 75,779,000 with a value of well over one billion dollars.

The second exhibit was designed primarily to show that there was a substantial movement of traffic not attributable to Lake Superior.

The special purpose of the third exhibit appeared to be to show the difference in tonnage through a canal of limited depth and deep water channels.

In connection with the fourth exhibit, Mr. Simms emphasized the fact that a very large number of automobiles were now shipped by water, both set up on their wheels and boxed, and also knocked down for export. In reply to a question by Mr. Keiser he confirmed the statement that this was potential traffic for the proposed Champlain waterway.

Improvement of Rivers and Harbours.—Discussing the last exhibit, No. 5, Mr. Simms said that the expenditures by the United States Government on rivers and harbours in the Great Lakes were equalled if not surpassed by the private

expenditures of corporations, port districts, and water navigation companies, to enable them to use this water transportation. The government expenditures on rivers and harbours between Lake Huron and Lake Erie amounted to nearly $27,000,000 up to 1932, and Mr. Simms said positively that the expenditure by other agencies far exceeded this amount.

Discussing the relative importance of shallow-draft and deep-draft waterways, Mr. Simms pointed out that the larger capacity of the deeper waterways made them more economical. Also in regard to the relative use of water and rail transportation he said: " Water transportation, generally speaking, is equated to rail transportation at three miles to one mile. I should say that if the rates were substantially under or even slightly under, some of the rates that are now in effect between Detroit and Atlantic seaboard points, traffic would move that way."

Overhead Bridges.—Another factor in the relative efficiency of canals was brought out by Mr. Simms when he said: " It does not matter how deep you dig a canal, if you do not remove the structures overhead you cannot do anything with it. There are, I think, some one hundred and twenty-nine railway or other bridges over the New York State Barge canal system, and several years ago when they started to operate motor ships from Detroit to New York, they had to put funnels on these vessels that could be tipped over, and pilot houses that could be tipped over, to enable the vessels to go through the New York State Barge Canal underneath the fixed bridges. If you dig that canal to a depth of 150 feet, it won't make any difference unless at the same time you can raise your clearances on these overhead structures."

George C. Foote

Mr. Foote of Port Henry, New York, and connected with the McIntyre Ore Company, testified on behalf of the proponents. The iron deposits of that Company were located in the Adirondacks, about thirty-five miles due west of Lake Champlain. The deposits had not been worked for a hundred years; in fact nothing had been done with the mine beyond the initial surveys, hole-drilling and test-pitting. The estimates varied between 100,000,000 and 200,000,000 tons of ore.

Titanium Ores.—Mr. Foote said: " That ore carries titanium, which has been supposed to be deleterious to the working of the iron ore in a blast furnace. That probably has been one reason which has kept it back, but the main reason why that body has not been developed has been transportation to rail or water.

"It is about thirty-five miles to either rail or water. That is a problem which is now being overcome by the use of trucks, because of the hard-surfaced roads which are getting into that country. In respect to iron ore, of course, in a highly competitive field, anything which will reduce the freight rates, makes the bodies of ore available.

"At the present time about 100,000 tons of titaniferous ore is coming into this country from Sweden or Norway. That growth has come from practically nothing to the present quantity in the last ten years; it is growing very rapidly. There is a movement on foot now to discover or develop a body of ore in the United States from which titanium could be derived. That is very much of an activity at the present time because of the dependence of the companies on ores from foreign countries to supply the titanium. Now that iron ore carries iron and carries titanium, and by separation methods each element can be separated so that you get the iron ore element as well as the titanium element.

"The Swedish importations are because of the titanium content, not because of the iron content. This deposit which I have been describing was originally developed or explored to determine the value as iron ore. Now it has developed that the so-called by-product which we had considered useless is becoming the valuable element, and the iron ore is more or less a by-product.

"This ore from Norway and Sweden is coming at the present time on a very low freight rate, which probably will not obtain as conditions are better, but it is necessary to meet that competition from our New York titanium deposits. We have, therefore, two elements, one the extremely competitive nature of iron ore, and the other the competitive nature of titanium ore with foreign importations."

From Mr. Foote's subsequent testimony, it appears that in his opinion a deep waterway by way of Lake Champlain would make it possible to develop these iron ore deposits.

Murray K. Hart

Mr. Hart explained that the New York State Economic Council was a cross-section of private enterprise in the State of New York, with members in almost every business activity, and a total membership of over fifteen hundred. Included in the membership were not only business and professional men but farmers, workers, etc.

His organization felt that the people of the State of New York were not interested in further great expenditures of money upon inland waterways so long as the Barge Canal remained as unsuccessful as it was. Traffic on the Erie canal had grown from the early days of the 1830's until it reached its peak in the 1870's, and from that time on it ran down. Never at any time since the Barge Canal was finished, had the traffic exceeded about 4,500,000 tons, and that with much advertising and much effort on the part of the State to promote its use.

The Economic Council held no particular brief for the railroads, but they were the largest taxpayers in the State. In any event the taxpayers had an inherent interest in the railroads not being undermined, because they were an important part of the financial set-up of the State. If any considerable portion of their business were taken away, it would unquestionably result in wrecking the railroads and possibly in their ultimate inability to meet their taxes, which would simply increase the tax burden of the people.

Transportation Facilities more than adequate.—Mr. Hart said: "It seems to us that as far as this country is concerned there is too much of the country's wealth invested in transportation facilities already. We have roughly $25,000,000,000 invested in the railroads, and many of them even in normal times find it difficult to make ends meet. We have another $25,000,000,000 invested in highways, much of which, perhaps the larger part of which, is invested due to the need of furnishing facilities for the very large trucks which are now going over those highways. Then we have another large amount—I do not know just how much, but I have heard the figures stated as several billion dollars,—invested in waterways. We have enough transportation facilities in this country to-day to last us for a pretty long time, and it seems to us that such an expenditure as this, at this time or at any other time in the future that we can foresee now, would be decidedly uneconomical... The Barge canal, with interest, has cost us to date $300,000,000, and we will be paying taxes on that for quite a while."

A. W. Stebbings

Mr. Stebbings, Traffic Manager of the Thatcher Manufacturing Company of Elmira, New York, representing the Elmira Association of Commerce, said that his organization objected to large expenditures of money for any project that would benefit certain industries or localities at the expense of others. "We are" he said, "firmly of the opinion that the principles laid down by the National Transportation Act, of which the late President Coolidge was Chairman, should govern in the investigation of these projects. Those

principles were stated as follows: 'That the projects should bear all the cost of amortization, interest, maintenance and operation of the facilities for their navigation.'

"I further say that the principles of the public convenience and necessity should also govern. The present facilities for handling the tonnage between Montreal and New York, or between the western section of the country and the eastern section of the country, including export, are at present sufficient to take care of the tonnage available and are sufficient to take care of the prospective tonnage that may be available in the not distant future.

"As taxpayers we object to the payment of freight rates or the differential reasonable freight rates and the sub-normal rates that are charged by the New York State canal, for instance, for the benefit of certain big industries, such as the Standard Oil Company and the Ford Motor Company, who are using the present facilities of the New York State Barge canal, and are obtaining transportation at sub-normal rates. The taxpayers of New York State are making up that differential between a good reasonable rate and a sub-normal rate. I object as a taxpayer to paying freight charges of the Ford Motor Company or the Standard Oil Company.

New York State Barge Canal Uneconomical.—" This statement by Colonel Green, which was quoted by the previous witness, stated that the difference in freight cost was so great that New York State could afford to pay to the railroads their regular going rates for the amount of tonnage handled and they would have been money ahead; that is, the cost of maintaining the New York State Barge canal was greater than the money that would have been involved by the regular freight cost of that amount of tonnage had it moved by the railroads. There was a differential in the cost of maintaining that canal over and above the regular railroad rate, so that they could well have afforded to give the transportation free of cost to the people who used it, and in addition paid the railroads their regular going rates. That looks to me like an uneconomical proposition, and as a taxpayer to the State of New York and to the Federal Government, I object to that kind of economies."

Purchasing Power of Railroads.—" There are at the present time operating between Montreal or serving that territory and the New York territory paralleling this proposed canal, the Delaware and Hudson Railroad and the Rutland Railroad, and there are many other railroads operating in the territory proposed to be served, and those railroads are not in a good financial condition.

" The country is very largely dependent upon the purchases of the railroads as regards their own financial condition. During the depression years, the average expenditure of Class 1 railroads of the United States for durable goods alone was more than $1,000,000,000 annually less than the expenditure during the normal period of several years prior to the depression.

" The loss of that purchasing power, in my opinion, largely retards our recovery from the depression. It is the durable goods industry that has suffered more than the others, and with the return of the purchasing power of the railroads, I personally believe we would see a rapid recovery; and I do object to any proposal coming along creating a vast expenditure, taxing the individuals and the industries and the railroads, all to create competition with the railroads when they are in need of relief.

" Even were this proposal economically justified, and it could be clearly shown that the future of the country would benefit from its development, I would still say that this is not the proper time to consider this vast expenditure. I consider that a project such as this should be deferred until conditions are more normal and we are in a business sense, working under profitable conditions.

"I will concede that water transportation is economically lower, justifying lower rates than railroad transportation, providing that the water transportation is over a natural waterway, such as the Great Lakes or the ocean; but I do not consider that it is justified where the maintenance costs of the waterway are not taken into consideration as to the going charges, and the difference has to be made up by the taxpayers. Personally, I am in favor of assessing a toll on the New York Barge canal. If it can be made self-supporting, I would be in favor of its operation; otherwise not."

Louis C. Madeira

Mr. Madeira, Executive Director of the Anthracite Institute, New York, stated that his organization was opposed to the proposed waterway for a number of reasons. They believed the project was commercially and economically unsound. If carried out at government expense at a cost of millions of dollars, it would provide a free right-of-way for industries located near the waterways at the expense of those located at inland points. It would tend to decrease employment, particularly in the anthracite region of Pennsylvania. Competitors of the anthracite industry, such as fuel oil, with pipe line delivery to refineries on water-front properties, would be able to transport their commodity in tank barges, whereas the anthracite industry, being located inland, would be unable to take advantage of lower transportation charges that might come as a result of a free right-of-way through the deep waterway now being considered.

Cornelius H. Callaghan

Mr. Callaghan, representing the Maritime Association of the Port of New York, asked and was given permission to file a brief. In regard to a suggestion that the rule governing coast-wise shipping might be modified so as to provide that either Canadian or American vessels might make any number of ports on the Great Lakes on either side, without being treated as foreign ports, Mr. Callaghan said that such a change would be disastrous to the American merchant marine. His Association would like to submit data showing that the Oswego route was more economical than the proposed Champlain route. So far as the St. Lawrence route was concerned, his Association was opposed to it, and they were equally opposed to the Champlain route.

Arthur M. Travers

Mr. Travers, Manager, Legislative Bureau, Merchants Association of New York, said that their Committee on Inland Waterways and Water Power, not having yet had an opportunity to study the problem in detail, would like permission to submit material to the Commission at a later date.

H. H. Powers

Mr. Powers, representing the Central Vermont Railway and also Canadian railways in so far as their interests might be affected, gave the Commission information in regard to coastwise shipping and the restrictions against foreign-owned vessels. He described a case in point, Central Vermont Transportation *vs.* Durring before the Supreme Court of the United States. The Court held in that case that any vessel owned by a foreign interest to the extent of more than twenty-five per cent, could not operate between any two ports of the United States.

Charles C. Wood

Mr. Wood, President of the Champlain Valley Council, and resident in Burlington, Vermont, explained that the Council was a federation of Chambers of Commerce and Boards of Trade extending from Whitehall, New York, to Sorel, Quebec.

Mr. Wood filed two exhibits, one covering the number of documented yachts regarded as potential users of the seaway. Mr. Wood was of the opinion that with the development of a through waterway, it would be used very extensively by pleasure craft, not only in going north and south between the Hudson and the St. Lawrence, but also to take advantage of the attractive features of Lake Champlain.

Statements in Opposition

Letters were read in opposition to the proposed waterway on behalf of the Central Mercantile Association of New York and the West Side Association of Commerce of the City of New York.

ALBANY

The Commission held a public hearing in the City of Albany, N.Y., on November 23, 1936.

D. S. Griffin

Mr. Griffin of Hudson Falls, New York, lumber and coal merchant, testified that a deeper waterway would be of material advantage to his own and other interests in and about Hudson Falls. Hudson Falls is on the Hudson River, south of Lake George.

Charles W. Barker

Mr. Barker of Granville, New York, representing the Vermont-New York Slate Manufacturers Association, spoke in support of the proposed waterway. He filed as an exhibit a statement covering sales of slate products in the Vermont-New York slate district between 1925 and 1935 inclusive. He said that the greatest handicap in expanding their market was the high cost of delivery, and was of the opinion that the opening of the proposed waterway would be of material advantage to his industry.

Fred Freestone

Mr. Freestone, Chairman of the National Seaway Council, was given the right to file a brief in support of the proposed waterway.

George F. Bayle, Jr.

Mr. Bayle, representing the Glens Falls Portland Cement Company, Glens Falls, New York, said that they were five or six miles from the Barge canal. Trucking of their product to the canal made the expense prohibitive. It did not appear, therefore, that it would make much difference to them whether they had the present shallow-draft or a deep waterway. There would, however, be some advantage in a waterway that would bring in coal at a lower price.

Arnold G. Chapman

Mr. Chapman, representing the New York State Waterways Association, was given permission to file a Brief.

James MacMartin

Mr. MacMartin, Chief Engineer of the Delaware and Hudson Railroad, testified in opposition to the proposed waterway. He described the location of the main line of the railway and its principal branches. He also went in some detail into the various routes that had been proposed from time to time between the Great Lakes and the sea, either international, all-Canadian or all-American, and their estimated cost. He argued that to a very large extent railroads were taking care of the needs of the territory and that so far as waterways were concerned, the existing New York State canals were anything but overcrowded. "We have," he said, "facilities in both railroad and canal capable of carrying from four to twenty-eight times the amount of traffic that at present exists.

"To sum up this matter, my own personal opinion is that at the present time there are enough waterway facilities and enough railroad facilities to supply all the needs and necessities of the traffic. If and when the traffic has increased

to a point where it is desirable to build a deep waterway, the interests of the United States would be best served by a waterway wholly within the limits of United States territory."

Mr. MacMartin filed three exhibits; the first a map showing proposed deep waterways from the Great Lakes to tidewater; the second containing estimates of cost and descriptions of routes from the Great Lakes to the sea; and the third, a map showing distances via proposed routes from Lake Ontario to the Hudson River.

Regulating Lake Champlain.—Mr. MacMartin said that as he understood it, the proposed deep waterway would involve raising the water level of Lake Champlain from 95, where it was at present on the Government datum, to possibly 102 feet. If that were done he said that a great portion of the Champlain division of the Delaware and Hudson railroad, extending from a point about three miles north of Port Henry to Whitehall, would be under water, if they had the floods which they had in 1928 and last year (1935), during which Lake Champlain rose eight feet. In his opinion it would never be possible to regulate the lake to 102 feet; the water level would probably be four feet above that height, and then when you had a south wind or a west wind on the lake, the tracks of the railway would be worthless between the points mentioned.

Improving Richelieu River.—Mr. MacMartin expressed the opinion that if the Canadian Government would improve the Richelieu River so as to bring it to the same depth as the Barge canal, there would be a material increase in traffic from Canada to the Hudson. He admitted, however, that even this limited depth would adversely affect the railways. Even at the present depths the Champlain canals could carry more freight if it was offered.

William E. Woollard

Mr. Woollard, President of the New York State Waterways Association, described that body as a voluntary organization composed of Chambers of Commerce and Boards of Trade along the route of the Barge canal system, and also the owners of craft and the operators of craft and the shippers of cargoes. He gave the Commission the following somewhat detailed account of the artificial waterways of New York:—

Transportation Facilities in New York State.—"Our contention is that New York State has provided all necessary means to transport all kinds of freight from any corner or part of the state, not only within the state but without the state, interstate or international commerce. As to the railroads in this state—and I am saying a good word for them, which I do not always say for the canals—we have over 8,000 miles of railroad outside New York city, and we have 18,000 miles of rails. Road and rails are more per square mile than in any other state in the union. We have the greatest highway system in the world for motor transportation. We have 47,000 miles of roads in this state—to be exact, 47,763 miles, of which 12,255 are improved highways of the finest and widest in the world."

Canal System.—"We have the greatest canal system man has ever built, 525 miles of barge canal system in the State of New York accommodating 2,000 ton barges. This canal is the longest that has ever been built by man, with the exception of the Chinese canal built in the fifteenth or sixteenth century. It has four great divisions, the longest from the Hudson River to Lake Erie—from Waterford, to be exact, to Buffalo. The distance is 334 miles, and that is

connected up in the middle of the State with Lake Ontario by the Oswego division. Uniformly throughout it is 12 feet in depth. In the Erie division there are 200 miles of natural waterways and 150 miles of artificial waterways. We connect up on the north through to Canada, from the Hudson up through Lake Champlain, down the Richelieu River to the St. Lawrence, to Sorel at the mouth of the Richelieu. Taking it all in all, I say it is the best, most efficient and best-equipped transportation system in a similar area in any part of the world."

Investment in Waterways.—"Around and about that transportation system is all our investment of capital, our industries—two-thirds, by the way, of all the population of the State live along the Erie Barge canal system. We assert it would be a tragedy to attempt to impair any of the investments that the people have made in all these facilities. There are outstanding to-day $150,000,000 of the Barge Canal bonds alone, and while we have a reserve fund of some $80,000,000 set up to finally redeem them, I would not attempt to state—other gentlemen probably will—what the railroad investment held by the public in this State amounts to; it is enormous. The State itself has invested untold millions in good roads. I want to tell you about the Barge canal, because something has been said about it and I am afraid some inaccurate statements have been made."

"The Erie Barge canal was completed in 1825 at a cost of $7,500,000. It paid back by tolls in seven years the cost of construction and started to pile up a surplus—an enormous surplus from tolls. Railroad competition came in, and railroad competition began then to take the surplus moneys from the canal tolls, to build railroads, if you please, between points not served by the canals. If you look at Chapter 170 of the laws of 1836, that is, eleven years after the completion of the canals, you will find that the State pledged its credit in the amount of over $3,000,000 to build what is now the Erie railroad from Chenango county west to Erie, an amount that was never repaid."

Canal Tonnage.—"Travel along further and you will find that more than $100,000,000 of money that came from canal tolls was used to build railroads, so that the child that was developed has come back in some degree to damn the originator of the whole thing, so far as railroads are concerned. We do not mind that, but we have had a Barge Canal system only since 1904—that was the very beginning, thirty-two years ago, when the constitutional amendment was adopted, and it was not completed until 1918. In 1918 the war was on; we turned the canal over to the government, and the government did not make any use of it; in fact we can claim it throttled it in order to help the railroads— throttled commerce on the canals. We got it back in 1922, and since then there has been a marvellous increase in canal tonnage. In 1926 it was 2,300,000; in 1935 it was 4,489,000; and this year it will be over 5,000,000—constantly increasing, ten per cent a year."

Champlain Canal.—"There is one backward division on this canal, and that is the Champlain division. That comes about, in some degree at least, as Mr. MacMartin said, by reason of the fact that Canada did not deepen the canal in its territory. From Rouses Point at our boundary line to the St. Lawrence, it still remains at 6½ feet, and the locks, I believe, are only 180 feet long, some of them less, accomodating less than 1,000 ton barges, whereas we can accomodate 2,000 ton barges. Our canal is most efficiently operated. It is under the Department of Public Works; Colonel Greene is a very capable official. They may say other things about him but they never said that he

was not efficient in the operation of everything under his department. This canal is quite an affair. There are 1,577 full time and part time employees. There are 57 locks. Eight hundred and twenty-three cargo carriers, consisting of barges, motor ships, steams, tugs and other craft, employ 2,486 men. In other words, this canal industry employs 4,063 men eight months in the year. On the Erie division there is a 24-hour service; on the Champlain division, there is a 12-hour service".

Prospective Tonnage for Champlain Route.—Mr. Woollard, referring to the testimony of Mr. Olds and others as to prospective tonnage on the proposed waterway, held that seven-eighths of it would arise west of Buffalo, and that it would be more economical to use the existing canal from Buffalo to the Hudson than to carry merchandise down to Montreal and by any of the proposed routes to Lake Champlain and the Hudson.

Estimates of Cost.—In regard to the cost of the project, he quoted the estimates in the 1900 Report of the U.S. Corps of Engineers of $168,000,000. Assuming that the cost of materials and labour had doubled between 1900 and 1936, it would be reasonable to consider this total as now doubled, or $336,-000,000. That would be only from Lake St. Francis to Albany. It would cost at least as much by the Sorel route.

Turning to the Oswego branch of the Barge canal, he pointed out that it was now being deepened from 12 to 14 feet. This was being done at the expense of the Federal Government.

There was already a very large investment on the existing route. Over $7,500,000 had been spent on the Port of Albany, which was handling half a million tons a year. They had the largest elevator in the world, with a capacity of 13,000,000 bushels.

As to the cost of the New York State canals, he said that the total from the beginning was $176,870,000, and he understood that the estimated cost of a ship canal from Lake Erie to the Hudson was $200,000,000.

In reply to a question, he said he did not believe that the little use made of the Barge canal was due to insufficient draft. The capacity of the canal was 20,000,000 tons, and the use this year would run over 5,000,000 tons. They had been increasing ten per cent annually for ten years. Wheat was no longer the principal item. It had taken second place to petroleum and its products.

In New York State a Legislative Committee had found about ten years ago that the existence of the Barge canal system was justified because it actually saved the people of the State $15,000,000 a year in railroad freight rate costs. The State's waterways had helped to keep down the rates and that was a wise thing to continue.

Barge Canal Tonnage.—In regard to the nature of the tonnage carried on the Barge canal, Mr. Woollard testified that grain took 19 per cent; chemicals, 6 per cent; sulphur, 4 per cent; sugar, 4 per cent; fertilizer, 3·76 per cent; scrap iron, 2 per cent; flour, 1·20 per cent; lumber, 1·15 per cent; molasses, 1·25 per cent; pig iron, 1·50 per cent; sand, nearly 2 per cent; petroleum and all its products, 40 per cent. This was in 1935.

Of all the cargo handled on the canal system, 90 per cent originated in and was consumed in the State of New York.

Mr. Woollard filed an exhibit in the form of a pamphlet entitled " The Railroads are attempting to Destroy New York's Great Canal System."

While Mr. Woollard opposed a deep channel by the Champlain route, he said that the people he represented would welcome a 14-foot channel. There had been an understanding at one time that both the American and Canadian

sections of the waterway between the St. Lawrence and the Hudson would be deepened to 14 feet, but Canada did not see fit to do that. The channel in the Richelieu still remained at 6½ feet, and the American end was 12 feet.

Samuel B. Botsford

Mr. Botsford, Executive Vice-president of the Buffalo Chamber of Commerce, first called the attention of the Commission to a published survey by United States Army Engineers entitled "The Port of Buffalo, Lake Series No. 1" (1931), and to the record of public hearings before the Committee on Rivers and Harbors of the House of Representatives, House Report 7593, entitled "Great Lakes to the Hudson River Waterway."

Mr. Botsford pointed out that they had in Buffalo the highest diversification of industry of any large city in the United States, and for that reason they would be benefited by any channel that might be recommended by the Commission and approved by the two Governments. Their only concern was at the present time what the general effect might be of the proposed improvements. The suggested Champlain canal was not as yet disapproved by the Marine Committee or the Transportation Committee of the Buffalo Chamber of Commerce, taken as a lone project.

Buffalo's Interest in Water Transportation.—Speaking of his organization he said: "I am not an employee of any public agency; I represent an organization that is composed of taxpayers only, and in order to convey to you something as to what our situation is there regarding our harbor, I might say this: Buffalo is entirely the product of transportation, by the Great Lakes, by the Barge canal, by railroads, highways, and recently by aviation. The Federal Government has just allocated over a million dollars to improve our airport.

"The harbor really extends over 25 miles from Niagara Falls along the Niagara river, south along Lake Erie to beyond the plant of the Bethlehem Steel Corporation, incidentally one of the largest in the world. Grain elevators, flour mills, feed mills, freight and passenger terminals, chemical and steel plants, warehouses, rubber factories and innumerable other things line the shores. Although many of these do not directly use the canals, their assembly and distribution is effected by other concerns which employ canal transit.

"More than 25,000 people are directly employed by Buffalo water front facilities not including manufacturing plants located on the water front. The number of persons depending directly on these activities is fully 100,000, this 25,000 and their dependents. Any change in present commercial routes will inevitably affect these people.

"As I have said, Buffalo harbor pays taxes. It is the only harbor, I think, where taxation is the outstanding feature. The assessed valuation of the water front inside the city was more than $115,000,000 in 1930, and the total investment is in excess of $200,000,000 on the frontier, and of over $900,00,000 of assessed value inside Buffalo. It can easily be shown that about $400,000,000 depends on water transportation directly or indirectly."

Mr. Botsford made it clear that the objection of his organization was to the proposed St. Lawrence deep waterway, rather than to the Champlain waterway. He felt that the testimony already presented before the Commission made it clear that the Champlain shipway was regarded as an integral part of the St. Lawrence development and could not be considered as an independent project.

The Chairman explained that the Commission was not now charged with the duty of considering the propriety of the St. Lawrence waterway. The only matter before the Commission was the Champlain waterway.

Tax-exempt Facilities.—Returning to the situation at Buffalo and the fact that Buffalo harbour was obliged to pay taxes to the city, Mr. Botsford thought

the fact should be emphasized that there were no tax-exempt facilities in Buffalo harbour except the State Canal terminal. On the other hand it was becoming the general policy to develop more and more tax-exempt facilities in American harbours, and the same applied to Montreal. He added, "The United States, if it is to have this change in development of its transportation, must in addition, either directly or through port development or through State aid, go into the business of matching the ports everywhere with tax-exempt facilities. . . . The tendency in Canada is to use government money to attract traffic by preferences—cheap terminal charges, low rail rates and favorable grading of products. To offset this, New York State or the Federal Government must provide similar facilities and competitive rates, assuming the traffic is induced to go that way. Private capital, of course, cannot compete with government-owned facilities."

Rapid vs. Slow Transportation.—Mr. Botsford suggested to the Commission that there were certain things that should be gone into before a decision was reached in connection with the proposed Champlain waterway. The first point was whether or not the United States was planning to enter upon a change from rapid delivery to slow delivery, plus an increase of storage. In that connection he referred the Commission to the Robinson-Patnam Act, which would undoubtedly be amended in the coming winter, and which contemplated the break-up of retailing and wholesaling and manufacturing along the lines now practiced in the United States. Some people believe that would lead to a very great increase in warehousing, and Mr. Botsford understood that bankers who had been deprived of a great many loans and deposits by reason of the rapidity with which merchandise now went from producer to consumer, were seriously considering what the effect of that would be on their communities.

Door-to-door Delivery.—The second point that Mr. Botsford thought should be considered was, what the effect would be on door-to-door delivery by the railroads, a matter which had been in effect in the west and was now being put into operation in the east. What would be the effect on the finished goods and merchandise which motor ships were now trying to carry? The effect of the new policy on the railroads might be very far-reaching.

Population and Transportation.—The third point was the question of redistribution of population in the United States. There had been testimony before the Commission as to millions of people that would be tributary to the new waterway. At the present time the United States, with the approval of the electorate, was engaged in a general policy of getting people to locate in States that were populous at the present date. The United States Government had already spent a great many million dollars on a housing project in Buffalo, and was reported to be engaged in another similar project to take care of a lot of people. If we were going to have a change in the location of population, it would tie in very closely with the transportation policy of the United States.

Control of Rail Rates.—The fourth point to be considered was the control of rail rates in the United States, either by government ownership or some other method. At the present time, rates were submitted to and finally approved by the Interstate Commerce Commission. If the Government was going to enter more actively into that field, a far different situation would be presented, particularly in eastern territory. The question of taxes in Buffalo, for instance, with the railroads owning approximately one-tenth of the entire authorization, was an extremely serious problem.

Competing Modes of Transportation.—The fifth matter was the control of competing lines, both water and truck. There could be no question that if the economic situation was to be dealt with satisfactorily, some control of competing

carriers in the United States would have to be brought about. Just on what basis, nobody knew, but if the Government of the United States was to insist that the water carriers that would use this proposed shipway must pay a rate at all comparable with the railroads, then you got into a very difficult situation. On the other hand, if it was to be the policy of the Government to put the railroads through the wringer and just obliterate their stock and some of their bonds, and make them government-owned and tax-exempt, things would be entirely different.

Competition of Imports.—The sixth point was the question of imports. If high tariffs and artificial schemes for controlling transportation were done away with, it was admitted by some people who had studied the question that the proposed St. Lawrence route, which would apply also to the Champlain route, would bring into the middle west agricultural products from nations where they could be grown much more cheaply.

In Buffalo they were tremendously interested in what would be the government policy in regard to coal and iron ore. There was the Bethlehem Steel plant in Buffalo. There was a little larger plant at Sparrows Point on the outskirts of Baltimore. They draw iron ore from all over the world. They run a special line of steamers from Chile carrying their ore through the Panama Canal to Baltimore. Was it to be the policy of the United States Government to have this cheaply produced ore brought into the Great Lakes region for plants at Buffalo, Cleveland, Detroit and Gary?

Economic Picture Changed.—Mr. Botsford emphasized the fact that since the Commission carried out its investigation in connection with the St. Lawrence deep waterway, the economic picture had almost entirely changed. At that time the principal factor was the transportation of wheat. To-day the grain situation had changed. The great mass of other commodities went by railroad and truck, and Mr. Botsford was of the opinion that the whole economic situation as related to these waterways should be resurveyed.

Erie Canal Successful.—As to the effect of the proposed Champlain waterway on Erie canal traffic, Mr. Botsford said: "The State of New York, with the aid of the Federal Government, for the purpose of taking care almost entirely of interstate commerce—and that principally I admit is oil—started this development to Oswego, making it 14 feet to compare with the St. Lawrence canals. They of course omitted to improve the old Erie canal from Three Rivers, which is just outside of Syracuse, to Buffalo, and we complained bitterly about that. But the fact is that people in hearings like this overlook the importance of the small barge, the small canal boat and those little facilities that go round the big habor and pick up small cargoes here and there and then are linked together for a long, slow voyage through the canal. If you gentlemen would go to England, you would see what I have in mind. Well now, we find that the old Erie canal, which is ignored by the people down here and in Washington who talk big on this subject, is still doing business in a very adequate way."

William E. Fitzsimmons

Mr. Fitzsimmons, President of the Albany Chamber of Commerce, stated that Albany and its business interests were opposed to the proposed waterway on the ground that it would involve an unwarranted expense and that no survey which had come to their attention would indicate that there was any necessity for a ship canal. "Albany," Mr. Fitzsimmons said, "was a natural trading centre." It was the complement to Buffalo as a terminal of the Erie Canal. It was the point that perhaps would get more of the benefit

of a deepening of the waterway up to the St. Lawrence than any other place between New York and Canada. But because of the money that Albany had invested, together with the sister city of Rensselaer, in conforming with the regulations of the Government in building ports and docks, and further because they had ample facilities in railroads, canals and highways, Albany wished to place itself on record as being opposed to the project.

In answer to questions, Mr. Fitzsimmons said that if the waterway proved practicable, Albany would be side-tracked, the ships would go by. "The reason why the government established a deep port at Albany was because of the expense of taking products off the ships by lighter on account of the big harborage expense and wharfage charges in New York. That was the only reason Albany has to offer for the making of a deep port. If you send these ships down to New York, you are going to be up against heavy lighterage and wharfage charges all over again."

R. Bruce Robinson

Mr. Robinson, Traffic Director, Albany Port District Commission, said that he concurred in the testimony of Mr. MacMartin of the Delaware and Hudson Railroad, and he added: "As to the advisability of providing a deep draft waterway from tidewater at Albany to Montreal, there is no justification for its construction. The present railroads and the New York State canals, with the Canadian canals to Montreal, have a capacity for handling more than four times the present tonnage offered. The present capacity is adequate for years in the future to accommodate all cargo offered for transportation to or from Montreal and intermediate territory."

Mr. Robinson said that he also concurred in the view expressed by Mr. MacMartin that if and when traffic showed a demand for a deep waterway to the Great Lakes, it should be an all-American route, which would be shorter and would provide a longer navigation season.

Tom J. McGrath

Mr. McGrath, General Counsel for the Brotherhood of Railroad Trainmen, said that the Brotherhood represented approximately 250,000 men engaged in train and engine service on the roads and in the yards of the United States, and approximately 45,000 men in similar capacities in Canada.

He said, "I want to make clear at the outset that it is not the policy of the organizations which I represent to oppose the institution and operation of competing transportation agencies merely because they invade a field upon which our members have relied for employment. If in the progress of commercial advancement, methods of transportation are developed which serve the comfort, convenience or necessities of the public better and more economically than do the railroads, we are prepared to bow to the inevitable and surrender our place in the transportation field.

"Until such time as it has been reasonably demonstrated that other forms of transportation can serve the public with adequate and efficient facilities in their respective fields at a cost based upon sound economic considerations, and until equality of treatment for all competitive carriers is raised to the same relative level, we propose to stand shoulder to shoulder with our employers and fight for the preservation of the industry upon which we rely for our bread and butter."

He would subscribe unhesitatingly to the principle enunciated by Prof. Charles H. Raper of Syracuse University, that "Economic planning contemplated the improvement and maintenance of waterways for transportation purposes whenever the need for such transportation is unmistakably clear, and whenever the entire cost of such transportation is not in excess of that supplied by other carriers."

Railroad Facilities in the United States.—Mr. McGrath testified that in 1929, the peak year in the history of American railroads, the number of tons of revenue freight originating on the lines of class I railways was 1,339,091,007. "This freight was handled without unduly taxing the railroad facilities then available. The total property investment in that year was $25,870,122,983. The number of originating tons of freight had been reduced in 1935 to 789,626,714, while the total property investment was $25,714,360,369, or substantially the same as it was in 1929. It will therefore be seen that the railroads of this country are equipped to handle at least double the amount of freight that is now being transported by them, without additional capital expenditure."

Highway Traffic.—"There are over 300,000 miles of State system highways in this country. In 1935 there were 3,655,705 motor trucks registered in the United States. During the first six months of 1936, registration of such vehicles increased 26·1 per cent over the corresponding period of 1935. When the foregoing figures are taken into consideration together with the fact that existing inland waterways now carry but a small proportion of their capacity, and that pipe-line mileage is being rapidly increased, it would be idle to contend that there is not an enormous transportation surplus.

"What has been said with reference to the surplus of transportation facilities in the country as a whole may be applied in relative degree to the territory through which this proposed waterway may be built.

"Is the proposal economically sound? If traditional governmental policy is to be followed, it is safe to assume that the proposed waterway will be tax free and toll free. Transportation, like any other commodity, must be paid for. So far as the railroads are concerned, it is paid for directly by the shipper. Waterway transportation is paid for very largely by the general taxpayer. The railroad shipper gets the direct benefit from that which he personally pays for. The favored few who benefit from water transportation, of the character under consideration, do so largely at the expense of a beneficent tax-paying public."

Subsidized Competition.—After testifying to the effect that railroad employees in the United States had suffered from subsidized competition, Mr. McGrath said:—

"The railroad employees would have no legitimate cause to complain if this diversion of traffic to other transportation mediums had resulted from economically sound and reasonably fair competition. Inland waterway competition has been made possible only by a governmental subsidy of untold millions of dollars. While the railroads have been required to build and maintain their own roads at their own expense, the States, with very substantial help from the Federal Government, have built and are maintaining, very largely at the expense of the general tax-paying public, a veritable network of super-highways to accommodate users thereof for commercial gain.

"Studies of the extent of the subsidy to commercial highway users, by a number of outstanding engineers in this country, have disclosed the fact that this subsidy in the United States amounts to approximately $595,000,000 per year."

In reply to a question as to his attitude towards waterways, Mr. McGrath said, "As a matter of policy we must of necessity maintain waterways for the protection of the Government in times of war. When it goes beyond the necessary protection or preservation of the Government as such, and creates cheaper rates by building mediums of commerce from the tax-payers' money, in the light of an admitted fact that we must have railroads equally in times of war, and for the growth, prosperity and continuity of the things that we enjoy in this country, I would say that the devoting of this excess money to the building of canals, deep waterways, and so forth, is not justified."

J. T. Hartigan, A. B. Bantham, H. A. Gilbert, J. H. Ross

Mr. Woollard told the Commission that Mr. J. T. Hartigan, Vice-President of the New York State Waterways Association, Mr. A. B. Bantham, Secretary of the Troy Chamber of Commerce, Mr. H. A. Gilbert, President of the Oil Transfer Corporation of New York, and Mr. J. H. Ross, President of the Inland Water Petroleum Carriers Association, desired to be recorded as opposed to the project.

R. E. Walworth

Mr. Walworth, Special Engineer of the New York Central Railroad, testified in opposition to the proposed waterway. He gave the Commission figures in connection with the cost of transportation over the Barge canal, which he said worked out in 1933 to two and a half cents per ton mile. The railroads carried the average commodity for one cent per ton mile.

Mr. Walworth filed as an Exhibit a pamphlet entitled "Year Book of Railroad Information, 1936," published by the Committee on Public Relations of the Eastern Railroads.

New York Department of Public Works

Mr. J. P. Newton asked to have it appear on the record that the Chief Engineer of the Department of Public Works, Albany, was represented at the hearing.

BURLINGTON

The Commission held a public hearing in the City of Burlington, Vermont, on November 24, 1936.

Louis F. Dow

Mr. Dow, Mayor of the City of Burlington, Vermont, presented a Resolution adopted by the Board of Aldermen of Burlington, in which it is said that the Board "Unanimously record its hearty endorsement of the completion of the Champlain-Hudson Seaway or cut-off, and urge upon the honorable Mayor of Burlington that he utilize every available resource at his command to assist the proper committees representing the Champlain Valley Council in presenting a full and comprehensive portrayal of the state and civic necessity for an early completion of the waterway."

Willsie Brisbin

Mr. Brisbin, a member of the Board of Aldermen of Burlington, informed the Commission that at a meeting of the Board on May 6, 1935, a Committee was appointed to be known as the Lake Champlain Seaway Committee. He appeared as a representative of this Committee to present facts in regard to the advantageous location of Burlington as a distributing point if the waterway should become an accomplished fact.

Mr. Brisbin supplied information in regard to Burlington, which he described as the largest port on Lake Champlain and the largest city in the State of Vermont. He mentioned its distance from various points, its population, port facilities, railroad lines, labour supply, opportunities of expansion, banking, hotel facilities, airport, surrounding farming region, and also as a logical terminal for trucks and motor vehicles.

Asked if there was any need for additional transportation facilities, in and out of Burlington, he said: "Of course from what I know about the transportation system in Burlington, at the present time, we probably are well equipped; that is, with the railroads and with the trucks, and so forth; but there is no reason to feel that there would not be an increase which would mutually help and expand the city as well if you had this seaway in operation."

In regard to Burlington's dock facilities, Mr. Brisbin was of the opinion that if the seaway went through the railroads would benefit from the additional traffic created and that they would cooperate by improving the dock facilities.

George Stanley

Mr. Stanley, City Engineer of Burlington, also a member of the Lake Champlain Seaway Committee, believed that if this new water route were established, it would necessarily benefit the State of Vermont and the City of Burlington in particular. The history of the industrial development of Burlington had been rather discouraging. At one time it had been one of the main distributing points for finished lumber. That industry had been replaced by oil distributing agencies. The oil came in by water and was distributed by rail. A deep waterway would stimulate industrial development.

Discussing water terminal facilities at Burlington, Mr. Stanley admitted that Burlington was not in a financial position to build terminals on the lake. That would be a matter for the State or Federal authorities. Asked if any industry in Burlington that needed water transportation at the present time was not well supplied, he replied: "So far as I know, all of the present industries are properly taken care of, so far as transportation is concerned."

Reverting to the question of finished lumber, and the decline of the industry, Mr. Stanley said: "I think the major element in the decline of that business was the tariff, but I assume the fact that they were paying freight on material that would not go into the finished product would also be a factor."

It was also brought out that oil and gasoline reached Burlington by an all-water route via the Hudson, the Champlain division of the Barge canal, and by Lake Champlain.

E. B. Loomis

Mr. Loomis, of Eddison, Vermont, said that he was in the distribution rather than the solicitation of apples for sale in New York State; also his family grew apples for sale. Eddison was on the shore of Lake Champlain. Apples would move by boat and it would mean a definite saving in transportation cost. Speed was not an outstanding factor.

Apple Industry.—Vermont produced from 500,000 to 600,000 bushels of apples at the present time. He believed that in about three years this would increase to 600,000 to 800,000. Next to New York City, their best markets were Boston, Albany, Syracuse, Utica and Newark. Massachusetts was their principal competitor. Distribution was the big problem. Movement by rail cost 25 cents a hundred pounds, exclusive of refrigeration. They were very much interested in the proposed waterway from the standpoint not only of the grower, but of the handler. At the present time the margin of safety was practically nothing. They needed extra markets. He had been asked about delivering fruit at Cleveland, but the high freight rate was prohibitive. If they could get a cheap freight rate, they could ship not only there, but to Chicago, Philadelphia and Baltimore. Their apple was the Champlain-McIntosh, which was known throughout the eastern seaboard.

It did not follow that improving the market for the McIntosh would be at the expense of other varieties of apple. The McIntosh appealed to certain classes of people and the market could be expanded without affecting other shippers.

Potatoes and other Commodities.—In regard to potatoes, Mr. Loomis said that the tonnage was about 2,128,000 bushels in Vermont, of which there were sold or for sale, 999,000 bushels. Vermont could not compete with Maine on seed potatoes because of the difference in transportation facilities.

Hay was practically a local proposition; there were 1,114,000 tons produced but only 44,000 tons sold. The transportation facilities were not available.

Cheap carriage by water would mean a great deal to the district; it would be an incentive to plant larger crops. He did not consider that the existing waterway between Lake Champlain and New York city could solve their problem. They lacked refrigeration and good facilities for loading.

Mr. Loomis believed that if the waterway were established, it would substantially meet their needs. There was at the present time no effective competition in the Vermont market with the Wenatchee apple. There would also be a large export market if sea-going vessels could be loaded at Burlington for foreign ports. The McIntosh apple would stand export to England, with refrigeration. Also the Vermont apple would find a certain market on this side as a substitute for apples exported.

F. S. Keiser, Refrigeration of Great Lakes Steamers

Mr. Keiser, reverting to the question of refrigeration on Great Lakes steamers said that following the Bridgeman-Russell case, three boats were equipped with refrigeration, under protest by the boat lines which had previously refused to handle dairy products. "The only way we could get the matter before

a judicial body was to make a complaint under Section 3 of the Interstate Commerce Commission Act, asking them to remove dairy products from the restricted list. It was in this way that the boat lines were forced to put ice-boxes on these three boats. I think they now have eighteen or nineteen boats, all equipped voluntarily with boxes, and much bigger boxes. The Minnesota Atlantic Transit has six boats, and they are all equipped with ice-boxes. It is the best east-bound business they have from the money standpoint."

Joseph Winterbotham

Mr. Winterbotham, First Vice-President of the Champlain Valley Council, member of the Executive Committee of the National Seaway Council, and Chairman of the Lake Champlain Seaway Committee of the Burlington Chamber of Commerce, said that he did not come as a shipper or one having any financial interest, and had nothing to gain personally, but appeared rather as a citizen who believed that the economic benefits to be derived would be of very great importance to Vermont, to Burlington and to the Champlain Valley. "I am thoroughly convinced" he said "of the potential commercial and transportation possibilities which the cut-off holds, and the definite benefits to both agriculture and industry throughout the entire area to be served on both sides of the international border. I cannot see how, nor have any arguments been presented to convince me that, the Hudson-Champlain cut-off will harm either temporarily or permanently, any common carrier already established. On the contrary, from reports which have been submitted to me, I believe the common carrier will derive sufficient benefits to more than balance any real or fancied losses."

Savings in Tonnage Rates

Mr. Winterbotham believed that the cut-off would enable the St. Lawrence waterway to be used a month longer each year. Great savings in tonnage rates would be effective on produce from the middle west and Canada to the eastern Atlantic ports, and of manufactured products from the east to the great middle west. It would have a direct favourable influence on industry and agriculture in Vermont. Industries would be brought nearer raw material markets, and lower rates on water-borne freight would permit Vermont industries to compete on a more equable footing with those of sea-port states. Also the big consumer markets both in the United States and Canada would be brought nearer Vermont. It was primarily an agricultural state but it had also its natural resources in the way of marble, granite, slate, talc, etc.

Mr. Winterbotham filed a Resolution unanimously adopted by the National Grange at its session in Columbus, Ohio, advocating the completion of the St. Lawrence deep waterway and ratification of the treaty.

Apart from local interests in Vermont, he emphasized the point that the Champlain route was a great natural artery of commerce, and with a little man-made help could be made productive to benefit a vast area of North America and bring material prosperity to millions of people.

New Traffic Created.—Answering the suggestion that the seaway would take a considerable amount of traffic from existing transportation, Mr. Winterbotham was of the opinion that the lost traffic would be more than replaced by new traffic created by the waterway. "The large railway centres are practically all ports—it may be a coincidence but it seems to me it is a fact. Looking back into the history of the endeavors of our little State to get this connection, I feel that Burlington especially and any other ports that happen to be on the waterway, would become really big distributing centres, and the railways would naturally get their share of the redistribution."

George Lumbra

Mr. Lumbra, representing the Champlain Valley Fruit Company of Burlington, said that theirs was a wholesale business; they brought products from different points in the United States and distributed in New York State. They dealt largely in bananas, which came by boat from New York and by cars to Burlington. It would be a big advantage to them if they could bring bananas to Burlington without water transfer. They also handled California oranges and Florida oranges and grape fruit. California oranges came all rail, and the Florida fruit by boat and rail. The transportation costs were approximately the same for 1,200 miles by water and 300 miles by rail.

His interest was definitely in the Champlain cut-off rather than in the St. Lawrence waterway, from Burlington south. He was not interested in water communication with the Great Lakes.

W. M. Fay

Mr. Fay, of Proctor, Vermont, Traffic Manager of the Vermont Marble Company, testified that there was a very large supply of marble in the Proctor district. They shipped by rail and by truck and also by boat to the Pacific Coast through New York. Their competition was in Georgia and Tennessee. He was not prepared to say if a deep-draft waterway to the Great Lakes would benefit his plant. It would depend on a great many factors. Unless the time competed, he doubted very much if it would be helpful.

Asked as a manufacturer if he believed it would be to the advantage of the City of Rutland and southern Vermont to have the Champlain seaway, he said that it was his personal opinion "that one thing the Champlain seaway would do would be to take away from the railroads in Vermont a great deal of their overhead traffic on which they now depend. I cannot think of anything much more tragic that could happen to the State of Vermont than to have the Rutland Railroad, for instance, go out of business. I say that personally and not by way of expressing the view-point of my Company."

Fred A. Howland

Mr. Howland, President of the National Life Insurance Company of Montpelier, Vermont, said that "In weighing the merits of the proposed Champlain seaway or cut-off as relates to Vermont in connection with the possible construction of the St. Lawrence Ship canal, I think consideration should be given to its effect upon the Central Vermont Railway; not merely because of the Railway itself but by reason of consequences important to citizens of the State."

Central Vermont Railway.—"About sixty per cent of the traffic of the Central Vermont Railway is what is known as bridge traffic, meaning through traffic originating outside of Vermont and destined for points outside of the State. It is quite plain, and I understand is admitted by the proponents of the seaway, that the great bulk of this traffic would be diverted to the proposed water route.

"If so, the conclusion seems quite obvious that the Central Vermont Railway would be deprived of the revenue which alone justifies the maintenance of the high quality of freight and passenger service now being afforded the public. As illustrating the importance of this bridge traffic, I am of the opinion that the rehabilitation of the railroad following the 1927 flood would not have been undertaken by the Canadian National except upon reliance on this source of income—with what lamentable consequences it is not necessary to speculate."

Bridge Traffic.—" Furthermore, the loss of this bridge traffic, or a considerable portion of it, would necessitate such a contraction in the excellent

freight and passenger service now afforded, as to be of serious results to all the communities on the line of the road. I think a fair demonstration of what might be expected is afforded by the meagre rail service now offered to the towns along the line of the railroad from Woodsville, through Lisbon, Littleton, Whitefield and Lancaster, in New Hampshire, because there is no through traffic to support better transportation.

" In addition to the withering effect of the diversion of the bridge traffic on rail service, there would necessarily be a heavy decrease in payrolls to Vermont citizens because of reduced operations.

"The Central Vermont now pays in wages annually to citizens of the State in round figures $2,200,000. The appropriation of the bridge traffic by the proposed seaway would reduce this annual wage payment tremendously, possibly three-quarters of a million dollars, and this would be practically a total loss to the State, as the water traffic would not absorb the resulting unemployment, and the revenue would go outside of Vermont. Of course the railroad would be far less able, even than at present, to pay to the State the annual tax now being collected.

"To put the situation as relates to the great volume of bridge traffic in a few words: at present, while outsiders get the service, Vermonters get the revenue. With the seaway in operation, outsiders would get both the service and the revenue, the vessels carrying the cargo being birds of passage merely using a free right-of-way through Vermont.

" Without attempting to measure the benefits or disadvantages of the proposed water channel in other directions, I ask that in reviewing the problem as relates to Vermont, due consideration be given to its effect on the railroads dependent on bridge traffic and on the service, wages and taxes which the railroads now contribute to the State."

Agricultural Interests.—In reply to a question from the Chairman, Mr. Howland said that the granite and marble industries of Vermont were very small as compared with the agricultural interests. And to a further question as to the effect on the agricultural industry of the State of a substantial reduction in freight rates, to distant points or markets like the central west and the Atlantic seaboard, he said that it would help all industries, agricultural and otherwise.

Granite and Marble.—Asked if the slow increase in population in Vermont and the failure to develop natural resources had been due to the fact that the people of the State were under a handicap so far as cost of transportation was concerned, since they were not near the sea and had to pay higher freight rates, Mr. Howland replied, "There may be some truth in it but I would say that the granite and marble resources have been very highly developed. The Vermont Marble Company is the largest manufacturer of marble in this country. They have the finest quarry equipment, in the town of Barre, and they sell their product all over the world. Possibly it might have been more highly developed if they had had sea-borne traffic, although I think that certainly has not been enough of an impediment to prevent the very large and profitable development of the quarry interests of the State."

To a question by Mr. Bartlett, "Is it not generally regarded in New England that the reason you have not built up big cities (in Vermont) is because you have not a comparable water-power (to New Hampshire), Mr. Howland replied, "I think that is a fair explanation of it". He, however, added, in answer to a further question, that power originating in Vermont was exported and used outside the state.

Harold W. Mason

Mr. Mason, shoe distributor of Brattleboro, Vermont, said that his firm was one of the largest distributors of shoe leather in the United States, and also one of the largest distributors of rubber footwear in the world. The name of the firm is Dunham Brothers Company.

As a shipper he did not feel that the proposed cut-off would be of any advantage to his Company. It would be a calamity to his business if anything were allowed to interfere with the prosperity of the two main railroads operating in the State. If they were unable to get the type of railroad service they now had, they would be unable to compete with the metropolitan areas of New York and Boston, where a large part of their business lay. The time element was all-important to them. If they were not able to deliver quickly, they just wouldn't get the business again. The amount of the freight rate was not of so much consequence as speed in delivery. Even if they were located on the waterway, they could not use water transportation because it was too slow.

G. C. Bailey

Mr. Bailey, representing the grain business of E. W. Bailey and Company, Montpelier, Vermont, testified that they had places of business not only there but at Swanton, Hinesburg Falls, Richmond, East Montpelier, South Lunenburg, in Vermont, and at North Haverhill, Woodsville and Colebrook, in New Hampshire. He said that he could not see how the proposed waterway would be of any benefit, but rather the contrary. It would be harmful if the railroad service was interfered with so that unemployment among railroad people would be increased. In the grain business your service is more important than the rate. So long as your competitors pay the same freight rate, it is not material.

Howard C. Rice

Mr. Rice, publisher of a country newspaper at Brattleboro, Vermont, said that his impression as a Vermonter was that the disadvantages to the State of the waterway would far outweigh the advantages. "One of the principal disadvantages," he said, "is that which has been mentioned here by previous witnesses—and that is the effect of such a cut-off, provided it did what its proponents said it would do, on the through railroad business of the State, particularly the through business of the Central Vermont. In our section of the State I know that the shippers feel they get excellent railroad service, and they are constantly conscious of the fact that the reason they get that service is the through business that the railroad has. I cannot see any possible way whereby the development of this cut-off, and even the establishment of a port in Burlington—which, by the way, is not quite as important a part of Vermont in the eyes of some Vermonters as it is in the eyes of some people in Burlington—would benefit us down in the Connecticut River valley. We are dependent on rail service down there, and that always will be the case. I do not believe that the advantage that might come from a port in Burlington, plus the local rates we would have to pay down our way, would be an improvement over the through rail rate we get now."

Effect of Seaway on Burlington.—"I cannot possibly see how this seaway, if it is built, would help a sufficiently large section of the State of Vermont to offset the disadvantage which would result. It might help Burlington; as I said to somebody the other day, if this seaway were built and was as prosperous and successful as its advocates seem to think it would be, Burlington might look like a seaport, in fact might even smell like a seaport at times, but I do

not think as a matter of actual fact it ever would be a seaport; it would be simply a flag station on the route, that is all. As I understand it, any big vessel in order to stop at a port profitably must not only have a lot of cargo to bring it but at the same time must be able to get from that place enough cargo to take out, so that it can have a two-way business. I cannot conceive of Burlington ever developing to that point, because I cannot see that there is enough potential business in the territory of which Burlington is the centre. That is my personal conclusion on the matter."

Recreational Interests.—Mr. Rice said that for the last six years he had been a member of the Recreational Development Committee of the New England Council, and among other things that Committee had proved that recreation was the second largest industry in New England, second only to manufacturing and outranking agriculture. "I know from personal experience," he said, "that there is no State in New England that benefits more proportionately from the growth of this recreational development movement than Vermont. I know also that this Lake Champlain district up here, that James Bryce called the playground of America, is the centre around which all Vermont's recreational development industry radiates. I cannot conceive myself how this seaway is going to do anything but interfere somewhat with recreational development along the Vermont area of Lake Champlain, particularly down to the lower end where it is narrow, almost like a river. It may be that an increased procession of barges going down there will add to the scenic beauty, but I cannot see it. I feel very strongly that much as we want to develop industry, much as we want to develop agriculture, one of our best bets in Vermont is the development of recreation. I cannot see, as I say, where this seaway would help that, and I think I can see where it would hurt it."

A. C. Brault

Mr. Brault, Traffic Manager of the St. Albans Grain Company, St. Albans, Vermont, read the following letter from his Company:

"From a long-range point of view, we look upon the Champlain waterway as very destructive to the majority of Vermont interests.

"To begin with, this water route would be closed five months of the year, which fact alone would not seem to justify the outlay of one hundred million dollars in public funds. During seven months of the year it would take enough freight away from our northern New England rail lines to endanger their being able to continue to exist.

"We operate entirely on an in-transit basis for manufacturing, processing and storage of grain and grain products. This waterway would make it impossible for the feed industries to continue operations in this section of New England, while at the same time there is no proof that it would decrease the cost of feed to consumers, because of the fact that whatever is saved on the transportation by water would probably be more than made up in the cost of transportation from the port to the ultimate destination whether by rail or other means of transportation.

"In our opinion, the position for Vermont to take is whether we want to retain our present transportation facilities for the benefit of the majority, or go in for this waterway which would benefit only a few; we can't have both".

Mr. Brault filed as an Exhibit a statement entitled, Rates on Corn (in cents per bushel—exclusive of elevator charges)—from Chicago, Ill., to St. Albans, Montpelier, Vt., and Boston rate points.

F. W. Shepardson

Mr. Shepardson of Burlington, told the Commission that his business was the manufacture and sale of breakfast foods. He had given consideration to the proposed cut-off not only as a manufacturer but as a citizen and taxpayer. "My conclusions," he said, "are that the disadvantages and the cost far outweigh any advantages that might come to us either as manufacturers or as individual taxpayers and citizens. . . . I think in considering any project of this kind the element of cost has to be taken into account; can the cost be justified? This project runs into very large figures, of which I as a small taxpayer would have to pay a small part. On the whole, however, I feel that the advantages in dollars and cents should be clearly shown to be greater than the cost of the project as a whole. And in considering the cost there is the fact to be had in mind, that it could not be used for more than seven months in the year; during five months in the year the investment in the project would be entirely idle, and we would have to rely on other forms of transportation. If these other forms of transportation were weakened as a result of the carrying out of this project, our service would be impaired, and, in our particular business at least, service is so important that we might have to consider relocating our plant."

Arthur S. McCarthy

Mr. McCarthy, locomotive engineer on the Rutland Railroad, and a member of the Executive Committee of the Brotherhood of Locomotive Engineers, said that he appeared before the Commission to explain the unemployment situation that would perhaps result if the proposed waterway were constructed. His organization was also concerned about the taxes that would accrue if the project were proceeded with. He read a statement setting forth his views as to the extent and cost of the waterway and what its effect would be on other transportation agencies. He gave figures as to the cost of the New York Barge canal which he considered an unprofitable outlay of public money.

L. G. Morphy

Mr. Morphy, General Superintendent and Chief Engineer of the Rutland Railroad Company, described the physical characteristics of the Rutland Railroad, the territory it served, and its terminii. He said that about half the tonnage handled on his railway originated on its lines; the other half was what was called overhead traffic. In regard to the proposed waterway he said:

"This project has been stated to cost probably upwards of $200,000,000. It is described as a waterway between Montreal and New York and, according to its advocates, proposed for the purpose of affording, in conjunction with the proposed St. Lawrence seaway project, a more direct and more protected route for ocean-going ships between the Great Lakes-St. Lawrence ports and foreign ports, and to bring about increased industrial and commercial developments in the territory to be traversed. Admittedly the project is economically unsound when considered by itself and is only worthy of any consideration from an economic point of view in conjunction with the development of the proposed Great Lakes-St. Lawrence deep waterway."

Central Vermont Railway.—Mr. Morphy said he had been authorized to say that the general statements he had made also applied to the Central Vermont Railway. The territory described between the St. Lawrence River and the Atlantic seaboard was now adequately provided with waterway facilities. In addition to the existing navigable route via the St. Lawrence River, there was an existing continuous waterway from the St. Lawrence at Sorel southerly via the Richelieu River, Lake Champlain, the Champlain canal and the Hudson River, to New York, affording navigation for barges and motor ships and having capacity many times the present small traffic volume.

"Little use" he said "is made of the Lake Champlain, Richelieu River waterway. Some lumber, hay, paper, paper mills supplies and coal are transported, the total traffic for the year 1936 being estimated at about 45,000 tons. Likewise there is only a small use made of the Champlain canal, the traffic handled, according to the Report of the Superintendent of Public Works of New York State for the year 1935, amounting to 351,000 tons, consisting largely of petroleum products, iron ore and scrap iron. Based on a study of the Army Board of Engineers, this canal had a capacity of at least 8,300,000 tons per annum.

"The railroads serving the territory have ample capacity to handle all the traffic offered and sufficient excess capacity for a substantial increase, as has been indicated by their ability to handle peak traffic movements prior to the depression. In fact, what the railroads are suffering from now is lack of sufficient traffic."

Rutland Railroad.—"The Rutland cannot hope to compete with this proposed subsidized free waterway. The waterway would divert badly needed traffic from it, resulting in large revenue losses which would weaken it financially, curtail its purchasing power, impair its ability to pay taxes to support the communities through which it operates, and to meet its funded debt obligations. In addition there would result loss of employment to railroad workers."

M. A. Bliss

Mr. Bliss, Statistician of St. Albans, Vermont, submitted to the Commission a statement showing the gross tonnage, gross revenues, pay-rolls of the Central Vermont Railway in Vermont, and the average number of employees in Vermont for the years 1926, 1929 and 1935.

George S. Howe

Mr. Howe, of Burlington, Vermont, filed with the Commission a statement purporting to show prospective traffic that might be expected to use the proposed waterway, together with figures of water routes from the Great Lakes and statistics of European canals.

PLATTSBURG

The Commission held a public hearing in the City of Plattsburgh, New York, on November 25th, 1936.

F. W. Nyland

Mr. Nyland, Coal Traffic Manager of the Delaware and Hudson Railroad, appeared on behalf of that Corporation and made a statement in relation to the shipment of coal, manner of shipment, route of transportation and rates, in connection with both anthracite and bituminous coal, to Plattsburg and Burlington. He professed to correct certain rate figures testified to by Mr. D. S. Griffin, at the Albany hearing.

Coal Movements.—He explained that the tide-water rates he quoted were rates ordered by the Interstate Commerce Commission, and that those to New York State generally and up through the Hudson River valley and Lake Champlain territory, so far as anthracite was concerned, were rates which had been set or approved by the same Commission. He mentioned that there had formerly been a substantial movement of anthracite coal from Montreal, which reached that city by rail to Lake Erie ports and thence by boat to Montreal. Twenty to twenty-five years ago that would run over 300,000 tons a year, but in 1922 the tonnage began to diminish and in 1927 the movement had ceased entirely. Since then Montreal anthracite had moved all-rail. There was a certain quantity of foreign anthracite brought into New England from Russia and the United Kingdom, with small quantities from Germany, Belgium and Indo-China.

Mr. Nyland testified that there was a substantial breakage in handling coal by water. This was not so serious a factor in bituminous coal, but in the case of anthracite it had to be re-screened and there was a considerable degradation, amounting to five per cent in excess of all-rail coal. Dealers preferred to get their coal in small quantities by rail.

In reply to questions he said that bituminous coal moved into New England from Norfolk, but not anthracite. Double the quantity of bituminous coal moved into New England compared with anthracite, and a substantial tonnage of the former moved by water. The anthracite all came from Pennsylvania.

Coal Prices.—Answering a question as to whether or not bituminous coal moved by water because it was cheaper, Mr. Nyland said: " There is more than one factor that enters into it. There is the price of the coal, which is a very large determining factor in moving coal into New England. In the southern fields the wage scales are much lower than in the northern fields, and mining operations are more favorable. They have thicker veins and your movement is largely based on your total loaded cars at destination." Pressed by the Chairman, Mr. Nyland admitted that he had no direct knowledge as to labour costs and could not quote any particular authority for his statement.

He said that twenty or twenty-five years ago, possibly longer, anthracite coal had moved by boat to points along Lake Champlain. He did not know if the handling plants had been dismantled, but he believed that there had not been any movement for at least twenty years.

J. A. Y. Gelder

Mr. Gelder, Treasurer-Manager of the Chazy Orchards, at Chazy, New York, testified on behalf of the proponents. They had 40,000 young McIntosh trees. Their normal crop was about 60,000 bushels, though on account of the cold weather they had only 15,000 bushels last year. He doubted if cheaper transportation to the New York market would be of benefit in shipping

apples, as they were a perishable product, but they could be handled by water if there was refrigeration. Their market was in the east, New York, possibly Boston, Washington and farther south. They used fertilizers and spraying materials in quite large quantities, from Baltimore and Camden, New Jersey, which might use the waterway. Theirs was the largest McIntosh apple orchard in the world.

R. A. Masten

Mr. Masten, Manager of the Birst-Forster-Dixfield Company of Plattsburg, New York, said that their business was paper manufacturer and converter. They imported coal, pulpwood and miscellaneous supplies, and shipped out paper and paper-manufactured articles. The proposed project would he believed be helpful to him in bringing in raw products and distributing finished materials. They imported about 12,000 tons of sulphite from Sweden, Germany and Canada. Their finished products consisted of wax-lined dishes and various waxed papers, jumbo rolls, tissue paper, etc., which went to all points in the United States.

Robert W. Foote

Mr. Foote, County Agricultural Agent of Clinton County, New York, gave a list of the products of the County, and was of the opinion that anything that would lower the cost of transportation would be of benefit to the County. At the same time he admitted that dairy products could not move by water because they must have fast transportation.

Mr. H. P. Mason, representing A. Mason and Sons, retail and wholesale lumber, of Plattsburg, said that they got their lumber from the southern and western United States and Canada. Pacific Coast lumber came by water through the Panama Canal and was transshipped at Albany. Southern and Canadian lumber came all-rail. The falling-off in the importation of lumber from Canada he thought was due mainly to the depression. The proposed waterway would help his business. A deeper draft waterway would give them the chance to broaden their field or output.

Ray Bender

Mr. Bender, County Agricultural Agent of Essex County, at Westport, New York, filed similar information to that put in by Mr. Foote, in connection with the products of Essex County. He believed that the deep waterway would furnish a market for a lot of their agricultural products.

John P. Ross

Mr. Ross, Secretary of the Champlain Valley Council, testified on behalf of the proponents and discussed in detail problems of transportation and distribution. "It is my studied opinion and conclusion" he said "that the development of a waterway from New York to Montreal with a draft of 30 feet, in conjunction with the development of the St. Lawrence waterway, will mean the elimination of some of the barriers that exist with respect to transportation; and, to make a definite statement, I would say that it will eliminate these barriers to a large extent for fifty million people residing in the United States."

Victor F. Boire

Mr. Boire, President of the Chamber of Commerce of Plattsburg, New York, said: "Most of the people who have studied it are convinced that the deeper waterway with what it connotes of the development of the St. Lawrence,

would make northern New York blossom as the rose. It would develop industry and develop those things that are now here but more or less dormant. It would help to decentralize industry and relieve congestion."

Mr. Boire submitted a resolution of the Board of Supervisors of Clinton County, and also one adopted by the Common Council of Plattsburg, in support of the waterway.

Benjamin F. Feinberg

Mr. Feinberg, State Senator, (New York), said that the people of Plattsburg were interested in the proposed deep waterway, but were concerned also to know what provision would be made for harbour and dockage facilities at Plattsburg. They would not be so much interested if it would be just a main channel running from Montreal to Albany.

C. R. Clark

Commander Clark, United States Navy, of Plattsburg, discussed the depth in the harbour at Plattsburg and its relationship to the Lake Champlain channel.

George H. Spring

Mr. Spring, of Port Henry, New York, Executive Vice-President of the Champlain Valley Council, said that he was employed by the Champlain Marine Company. He read into the record particulars as to tonnage from various firms in the district that might be expected to use the proposed waterway. He filed a copy of the New York State Museum Bulletin, July-August, 1919, containing particulars as to minerals in the Champlain district; a paper entitled, "Growth of Population of New England States" covering the period from 1790 to 1930; a document headed "Department of Commerce, Bureau of the Census, Biennial Census of Manufactures, 1933"; and a document entitled, "United States, Department of Commerce, Bureau of the Census, Census of Manufactures, 1933, Vermont, Summary of Industry"; also a document entitled, "Report of the State Geologist on the Mineral Industries of Vermont, 1933-34." These five documents were filed as exhibits.

MONTREAL

The Commission held a public hearing in the City of Montreal on November 26-27, 1936.

Louis Regnier

The first witness at the Montreal hearing, Louis Regnier, President of the St. Johns, P.Q., Board of Trade, described previous efforts to improve water transportation on the Richelieu. He was strongly in favour of the proposed deep channel, which would reduce the distance between New York and Montreal by about 1,079 miles. While Montreal, Quebec and Three Rivers would derive the greatest profits, every city along the improved waterway would benefit by better access to sources of raw materials. This would also apply to American cities along the waterway.

Canadian Lumbermen's Association

A communication was read from the Secretary-Manager of this Association, stating that the industry was not interested in the subject matter of the Investigation.

Canadian Industries Limited

A statement was read from Canadian Industries Limited setting forth the tonnage of nitrate of soda, sulphur, muriate of potash and phosphate rock handled by barge from steamer at Sorel to the Company's plant at Beloeil, also tonnage of dynamite from Beloeil to Newfoundland.

Charles C. Wood

Mr. Wood, as President of the Champlain Valley Council, explained the international character of the Council and the reason why it was being represented at the Montreal hearing. In answer to a question he said that the Boards of Trade of St. Johns, Iberville and Sorel were represented on the Council.

John P. Ross

In accordance with the authority given to him at Plattsburg, Mr. Ross filed a statement setting forth economic data and arguments in favour of the proposed waterway. " If constructed " says the statement, " the seaway will bring about great development of agriculture, industry and commerce in the Champlain valley. It will, by reducing costs of transportation, open up great markets, both national and world wide to business in this area. It will develop population in a region that has lagged behind other sections of the United States and it will bring wealth to a region that is not now wealthy. Vast new industries will be quick to see the value of locating in this area. None of these will, however, fully justify the building of the Hudson-Champlain seaway. Without the building of the St. Lawrence seaway and power project, there would not be sufficient commerce using the waterway to justify its existence. . . . The building of the Hudson-Champlain seaway in conjunction with the St. Lawrence seaway and power project would cause factories to spring up, employment to increase, population to grow, purchasing power to be enlarged; all of which would greatly benefit business and agriculture in this region."

Benefits of Proposed Seaway.—The statement concludes with the following: " It is our studied belief that the building of the Champlain-Hudson seaway will bring great and permanent benefits to the Hudson-Champlain valley and will favorably affect every branch of human endeavor in this area. Agriculture,

industry and commerce, together with their related services, will prosper and grow under the stimulation of low-cost power and low-cost transportation. We believe that the seaway will be, if constructed along the plans already formulated, of permanent value to the Champlain valley area, as well as to the country as a whole."

Appended to this statement is a supplement dealing with the beneficial effects that would follow from the application of low-cost power developed on the St. Lawrence to industries in the Champlain valley.

There is also appended to the statement a series of opinions by individuals as to the economic importance of the St. Lawrence deep waterway.

Jacques Cartier

Speaking on behalf of the City of St. Johns, Mr. Cartier gave the Commission a list of its principal industries. From their point of view the improvement of the existing water route by way of the Richelieu would be preferable to the digging of a canal from the St. Lawrence to Lake Champlain. In answer to questions Mr. Cartier expressed the view that a deep draft waterway of 27 or 30 feet would be preferable to one of limited draft. However, they would be glad to have a 12 foot or 14 foot channel if the greater depth was not obtainable.

Stanislas Poulin

Mr. Poulin said that he represented the interests of the Richelieu Valley. He submitted figures designed to illustrate the importance of the traffic, particularly the local traffic, that might be expected to use the deep waterway.

Shipments of Paper.—In reply to a question by the Chairman as to whether or not paper products were at the present time going from Three Rivers by way of the Richelieu to New York, Mr. Poulin said: "The Donnaconna Paper Company and the International Paper Company last year operated a new kind of boat—a motor-power boat with a capacity of about 225 tons—of course it is only a small boat, but that is the highest they can load. Last year they operated one of these boats; this year they operated four. I may say that in 1934 there was practically no paper at all going through this canal, and no pulp. This year, 1936, up to the 12th of October, 10,500,000 tons of paper and pulp had gone through. As stated a moment ago, we export about $30,000,000 worth of pulp and paper from the Province of Quebec. The mills are situated from Three Rivers to the Gulf. If we had a more direct means of transportation I think it is only fair to say that at least half of this could go through the shorter and cheaper route."

Asked to clarify the last part of this statement, he said: "The newspaper owners in the United States are of course looking for better prices. They will go to Newfoundland or to Norway if they can get their paper there at 25 to 50 cents a ton cheaper than they can get it here, and I am pointing out that that is the reason why they import some of their newsprint from Newfoundland and Norway. If this new route could save $2 a ton of the transportation only, I suggest they would import their newsprint from Canada, especially from the Province of Quebec, rather than go to Norway and Newfoundland to get it."

Coal Traffic.—In regard to coal traffic, Mr. Poulin said that in his early days he had seen barges loaded with American coal going through the small canal at St. Johns. The industries of St. Johns used to bring their coal by boat, but with the passage of time and the high cost of operating these small boats, this trade had almost gone down to nothing. Canada bought most of its coal from Pennsylvania, and for the quantity that was used in Quebec, the natural route was through the Hudson-Champlain waterway and the Richelieu River. Most of the coal came to-day by rail.

Syracuse Chamber of Commerce, Wellsville Chamber of Commerce, Harbor Carriers of Port of New York

Telegrams from the Chambers of Commerce of Syracuse and Wellsville, New York, and a letter and statement from the Harbor Carriers of the Port of New York, expressing opposition to the proposed waterway, were read into the record.

Chambre de Commerce, Montreal

Mr. Paul A. Beique submitted a statement on behalf of the Chambre de Commerce of Montreal. The Chamber was of the opinion that the proposed waterway by way of Lake Champlain to the Hudson, if considered as a separate project, was economically unsound. If it was to be considered as a necessary part of the St. Lawrence seaway proposition, the Chamber would like the privilege of filing a memorandum at a later date. In the meantime they asked for data as to routes, estimates of cost, possible power development, probable traffic, capital cost and so forth.

Mr. Beique filed two Exhibits, one showing traffic on the Chambly Canal, 1900 to 1935, and the other traffic on the Chambly Canal and St. Ours Lock, 1910 to 1935, with main commodities.

George H. Montgomery

On behalf of the Montreal Light, Heat and Power Consolidated, Mr. Montgomery read a letter pointing out that the Montreal Light, Heat and Power Company was the owner of the bed and banks of the Richelieu River between the south end of Ste. Therese Island and Chambly Basin; that Montreal Light, Heat and Power Consolidated control and operates a power development at Chambly Canton, which utilized the natural flow of the Richelieu River; and that the same organization also owns a dam and power site in the Richelieu River between Fryers Island and Chambly Canton.

It was pointed out that if control works were constructed in the Richelieu River and operated solely for navigation purposes, they might completely destroy the firm and dependable power output of the existing plant, render valueless the auxiliary power site and also seriously impair the rights of the Company in the bed and banks of the Richelieu River.

It was further submitted that any scheme of regulation of the Richelieu River for navigation purposes should be such that the natural regimen of flow would not be adversely affected for power purposes, without adequate compensation to the Company.

Mr. Montgomery, on behalf of his Company, offered to submit all the information in their possession as to lake levels and other engineering data.

F. P. Connolly

Mr. Connolly, Superintendent of the Napierville Junction Railway, which operates a line from Rouses Point junction on the international boundary north to Delson, the junction point with the Canadian Pacific Railway, explained that it was a subsidiary to the Delaware and Hudson Railroad, and gave the Commission evidence as to the length and character of the road, capacity, traffic, etc.

F. S. Keiser

In response to a question asked at one of the previous hearings, Mr. Keiser put in a statement with regard to electrical energy in Vermont, going to show that Vermont was now a heavy exporter of electrical energy.

J. K. McNeillie

Mr. McNeillie supplemented the evidence given by Mr. Connolly by submitting testimony as to the total tonnage handled through the Chambly Canal and over the Napierville Junction Railway, 1923 to 1935 inclusive. This statement showed that the tonnage on the railway diminished in those years by about 28 per cent, and on the canal by over 75 per cent.

National Seaway Council

Mr. Keiser filed a statement from the National Seaway Council, stated to include representatives of the leading national farm organizations and regional state and municipal bodies, in support of both the St. Lawrence deep waterway and the Champlain waterway.

Vermont Platforms

Copies were placed on record of extracts from the platforms of the Republican and Democratic parties in the State of Vermont, both supporting the Champlain waterway.

City of Sorel

A telegram was filed from the Mayor of the City of Sorel, approving of the improvement of a waterway between Canada and the United States, by way of the Richelieu River.

A similar telegram was received from the Chamber of Commerce of Sorel.

Rotary Club, Port Jervis, N.Y.

A letter was filed from the Rotary Club of Port Jervis, New York, opposing the waterway.

Norwich, N.Y.

A letter was filed containing a resolution of the Board of Directors of the Norwich Chamber of Commerce, in opposition to the waterway.

H. G. England

Mr. England, a granite manufacturer of Barre, Vermont, testified as to the granite industry in that State, the resources, methods of transportation and outside markets. He was of the opinion that a deep waterway would be of benefit to the granite industry in Vermont.

T. T. Lawson

Mr. Lawson, General Manager of the Barre Granite Association, Montpelier, Vermont, said that his Association comprised all except one of the granite producers in and around Barre. He supplied figures as to tonnage of granite for the years 1926 to 1935 inclusive, and also as to transportation charges.

Frederick L. Wheeler

Mr. Wheeler appeared on behalf of the Associated Railroads of New York State, including the Baltimore and Ohio, the Boston and Maine, the Delaware and Hudson, the Lehigh and New England, the Delaware, Lackawanna and Western, the Erie, the Fonda, Johnston and Gloversville, the Lehigh Valley, the Long Island, the New York Central, the New York, Chicago and St. Louis, the New York, New Haven and Hartford, the New York, Ontario and Western, the Pennsylvania Railroad and the Railway Express Agency.

Richelieu Waterway Depends on St. Lawrence Project.—In his introductory remarks Mr. Wheeler said:

"While the Act of Congress requesting this investigation makes no reference to the Great Lakes-St. Lawrence deep waterway, but refers only to the improvement of a waterway from Montreal to the Hudson River, we apprehend that no one would have the temerity to suggest the latter project except in conjunction with the former. Even the proponents concede—as the minutes of the hearing in New York on November 19th will show—that the Champlain-Hudson cut-off, as an independent project, cannot be justified on any ground. In other words, the proponents admit that this proposed cut-off is not economically practicable or desirable when considered by itself and should be developed only as an auxiliary outlet to the proposed St. Lawrence seaway.

"All the evidence adduced by the advocates of the project under consideration and their arguments in support thereof are based upon the hypothesis of a continuous deep waterway from the Great Lakes via Montreal to New York by an inland passage, which, it is said, would afford a more direct and protected route for ocean-going ships operating between ports on the Great Lakes and St. Lawrence River and ports on the coast and in foreign countries.

"It is also urged by these same advocates that the construction of a deep waterway, as an auxiliary outlet to the proposed seaway, from the St. Lawrence near Montreal to the Hudson near Waterford would bring about increased industrial and commercial development in the territory through which it would pass."

Champlain Project Economically Unsound.—"The record shows conclusively that the proposed Champlain-Hudson cut-off is economically unsound if the Great Lakes-St. Lawrence deep waterway is not developed, and is barren of any conclusive evidence showing or tending to show that the proposed cut-off is economically sound as an auxiliary to the St. Lawrence seaway if developed."

Mr. Wheeler stated that the conclusion to which the Association had come was as follows: "We respectfully suggest that the investigation is premature and that no recommendation as to the advisability or otherwise of the proposed cut-off should be made by your Commission until after final disposition of the Great Lakes-St. Lawrence deep waterway treaty."

B. S. Voorhees

Mr. Voorhees appeared as Assistant to the Vice-President of the New York Central Railroad. He said that considerable studies had been made of various waterway projects, including the St. Lawrence seaway. The fact that they were not in accord with the claims or contentions of the proponents of the proposed waterway did not mean that the rail carriers were opposed to competitive transportation under any and all circumstances. On the contrary, the rail carriers believed that the successful development and solution of the transportation problem depended upon the coordination of rail and water routes. In other words, these two systems of transportation should supplement and complement each other. Neither should be permitted to cripple or destroy the other. In the present case, the rail routes and the proposed deep waterway could not be so coordinated or adjusted as to secure a profitable utilization of both routes as means of transportation. The proposed waterway would only duplicate the extensive transportation facilities already existing between the Great Lakes-St. Lawrence River territory and the Atlantic seaboard, which facilities were being used far less than the capacity.

Associated Railroads

Mr. Voorhees said that the Associated Railroads opposed the Champlain-Hudson cut-off for the following reasons:

(*a*) As common carriers they are required by law to, and do, provide the public with continuous, adequate, efficient, and safe transportation service in the territory through which the proposed deep waterway would pass.

(*b*) The railroads of the United States pay taxes amounting to approximately $300,000,000 annually—about $30,000,000 of these taxes are paid in the State of New York, consequently they should oppose all unnecessary and improvident public expenditures, especially those which result in subsidizing or otherwise unfairly assisting their competitors.

(*c*) They have invested many millions of dollars in property devoted to transportation purposes, the value of which this project would substantially impair."

Subsidized Competition.—Mr. Voorhees said that they believed that there was no public necessity for the proposed improvements; that there was no existing or prospective traffic warranting it; and that the expenditure of public funds to the amount necessary to produce it would be a sheer waste of money and would further subsidize competition with the railroads. Both water and highway transportation, he said, had been subsidized, the former to the full extent of the overhead costs, and the latter extensively. He presented some figures in regard to the conditions of highway and water transportation, and said, "We further believe that the subject under investigation warrants a full development of the facts and that when such facts are fully developed, the evidence will show that no present or foreseeable public necessity suggests the advisability of the expenditure involved to create the proposed deep waterway."

National Transportation Committee Report.—In support of his contention that full consideration, in cases of this kind, should be given to the effect that the proposed improvement and the extension of operation on inland waterways would have upon other forms of existing transportation, he quoted from the Report of the National Transportation Committee (sometimes referred to as the Coolidge Committee), dated February 13, 1933, and also from a report on Water Resources and Transportation of the Mississippi River by a subcommittee of the National Resources Board, made in 1934.

Mr. Voorhees filed as an Exhibit a map showing the proposed deeper waterway from Montreal to New York.

He also submitted figures showing the gross revenue, net income and tonnage of the seven railroads directly affected by the proposed waterway, for the period 1929 to 1935 inclusive. His statement shows that during the year 1932 the deficit of these seven railroads was $23,728,016, in 1933 it was $14,576,058, in 1934 it was $16,930,062, and in 1935 it was $7,151,733.

Winter Traffic.—Discussing the effect of the waterway upon the railroads, Mr. Voorhees said: "The construction of the waterway would not permit the abandonment of the railroad facilities as they would be required to handle all the traffic during the winter months, when it was not possible to operate upon the inland waters. In other words, the railroad facilities which would have to be sufficient to take care of the peak requirements of traffic movement during the winter months would partially lie idle during the season of waterway operation, with a consequent waste of capital."

Railroads as Taxpayers.—Discussing further the possible effect of such a waterway upon the railroads, Mr. Voorhees said: "The railroads are handicapped

in their efforts to compete with a subsidized free waterway. The proposed waterway, during the season of navigation, would divert badly needed traffic from the railroads, resulting in large revenue losses and thereby weaken them financially, curtail their purchasing power, impair their ability to pay taxes to support the communities through which they pass and to make interest payments on and repayment of federal loans. It would also produce loss of employment of railroad workers."

"The railroads are the largest individual taxpayers and on them depend to a very considerable extent the financial support of schools, fire and police protection, public work, etc. It is a mistake to impair the ability of the railroads to continue their large tax payments. The effect on certain of the adjoining railroads which are finding it extremely difficult to exist might be sufficiently serious to throw them into bankruptcy and thereby jeopardize railroad service to communities through that railroad's entire territory."

No Demand for Waterway.—Mr. Voorhees added: "It is fallacious to assert that this proposed waterway would create business or attract industries at points along its course. As an economic proposition, it is the existence of a well-developed and populous hinterland which brings about a commercial demand for the improvement of a waterway, and not the presence of a waterway which effects an increase in business and industry in the hinterland."

Mr. Voorhees filed as an Exhibit a copy of Senator Wagner's speech on the Great Lakes-St. Lawrence Deep Waterway Treaty, on January 10, 1934. He also filed with the Commission as a matter of reference, copies of a book entitled, "The St. Lawrence Navigation and Power Project," a study prepared by the Brookings Institution of Washington in 1929.

Prospective Traffic.—Discussing the testimony and exhibits presented by proponents of the waterway, he said that these included statistics covering all the traffic handled on the Great Lakes, the Atlantic seaboard, the New York State barge canal, and the total water-borne commerce of the United States, but he argued that such statistics formed no basis as to the amount of traffic that would actually move over the proposed Champlain waterway as nothing had been presented to show that the traffic between the Great Lakes territory and the Atlantic seaboard and southern points would seek routes other than those now available. He contended that the evidence submitted showed that the commerce on the Great Lakes consisted largely of coal moving westbound and ore and grain eastbound, and that this traffic would have no possible occasion to use the proposed waterway.

Costs would Exceed Benefits.—" In order to reach a proper conclusion as to the economics" he said " it wil be necessary for your Honorable Commission to have a reasonable estimate of the potential traffic that will use the proposed cut-off based on actual traffic movements, without diversion from existing transportation facilities, and a comparison of savings, if any, based on such traffic with the interest and amortization charges on the estimated cost of construction plus maintenance. We desire to call attention to the fact that, based on studies of other waterway projects, the development of the economics of this project by this method will show that the costs will exceed the benefits. It will further show that transportation via the proposed waterway, if all of the costs be included, will be more expensive than transportation via the railroads." To illustrate this contention he quoted figures in connection with the New York State Barge Canal.

Regulation of Waterways.—Under cross-examination by Mr. Keiser, Mr. Voorhees admitted that there was a certain regulation of waterways by the Interstate Commerce Commisison and the Maritime Authority; and that the

deficits suffered by the railways were due more to the competition of trucks than to water competition. Reverting to Mr. Voorhees' previous statement that the tonnage on the Great Lakes is largely coal, ore and grain, Mr. Keiser asked the witness if there was not a large movement of so-called package freight both eastbound and westbound on the Great Lakes, and the witness agreed that that was correct.

J. B. Knox

Mr. Knox, President of the Interprovincial Lumber Company, was given permission to file a statement in support of the waterway.

Rimouski Chamber of Commerce

A telegram was filed from the Chamber of Commerce of Rimouski, Quebec, in support of the waterway.

P. C. Armstrong

Mr. Armstrong, Special Representative in the Traffic Department of the Canadian Pacific Railway, told the Commission that while he was not presenting a case for the railway, he had been permitted to appear to answer any questions concerning the economics of the subject. He pointed out that as both sides had agreed that the Lake Champlain waterway must be regarded as merely an extension of the original plan for the St. Lawrence waterway, it was quite impossible to discuss the matter now before the Commission without at the same time expressing an opinion concerning the St. Lawrence project, but he would confine himself to the economic aspects of the question. It appeared to him that the arguments submitted by the proponents were based on some misapprehension of the relation between water and rail transportation, and an equal misapprehension of the difference between various types of canals.

Types of Canals.—Taking the second point first, he said that there were three types of canals: artificial straits, such as the Suez, Panama and Kiel Canals, and the canals at Sault Ste Marie; ship canals, such as the St. Lawrence channel, the deepened Hudson and the Manchester ship canal; and third, internal waterways intended to offer trade routes similar to those provided by railways and highways.

It was obvious that the first type of canal had no relationship to the present problem. It must be considered as coming within one of the other two classes. A ship canal of deep draft as long as the one proposed, and including as high a lift, would be a unique experiment. Waterway development had been carried very far in Europe, particularly in France, Germany and the Netherlands. These internal waterways, which were a very important part of the national communication systems, were in almost all cases shallow-draft barge canals. That was the normal type of canal for the use of domestic commerce throughout the world.

Rail and Water Transportation.—As to the relationship between railway and canal transportation, it was not true that movement of goods by water was always cheaper than by rail, if consideration was given by the public to the true cost of the two types of transportation. In other words, the cost, including a proper provision for the construction and maintenance of waterways as well as railways. It was only in a country like the Netherlands where the mileage of canals was equal to or greater than that of the railways, that canals could be considered as a true alternative to railways. In North America the maintenance of a suitable network of railways was absolutely essential to providing the cheapest national system of transportation.

Deep vs. Shallow Canals.—Mr. Armstrong was definitely of the opinion that deepening a canal did not automatically add to its economic value. He instanced the case of wheat movements from Buffalo to New York by the Barge Canal and from Buffalo to Montreal by the St. Lawrence Canals. It was a hundred miles longer by the Barge Canal route, and the effective depth was less by that route, and yet the figures showed that there was a definite advantage in freight rates by the longer and shallower canal.

So far as the Hudson-Champlain cut-off was concerned, not only did he doubt whether the deepening would lower transportation charges to the public, but he was also convinced that the cost of construction must play a definite part in deciding the economic advantage of the project. That advantage could not be measured by merely comparing the charges which operators on these routes made to the public for their services.

Foreign Water Competition.—In the event of ocean steamers using the proposed deep waterway, Mr. Armstrong anticipated that it would involve the destruction of a great deal of capital now invested in inland fleets and a corresponding destruction of employment for the sailors of these fleets. While the coastal laws of the two countries might retain for their nationals the business between their own ports, foreign ships would be able to engage in all transportation of goods between ports of the two countries and between the inland ports of North America and foreign ports. Success in attracting the ocean shipping of the world to the inland waters of North America would probably be a fatal blow to the inland shipping interests of the United States and Canada.

Rate Reductions.—Answering a question as to the advantage of lowering the freight rate on a particular commodity, Mr. Armstrong said: "No railway traffic man fails to realize that the only desirable type of rate decrease is a general one made possible by general savings in cost of operation. Individual rate reductions seldom fail to hurt someone as well as to help someone else."

Technical Studies Needed.—Surveying the general situation, Mr. Armstrong suggested that: "A reasonable course would be to adjourn these proceedings long enough to permit the proponents to prepare a real case in favour of their contention; that that case, as far as it deals with transportation, and the possibility of diversion of routes, might be analyzed carefully by the technicians of the Board of Railway Commissioners and the Interstate Commerce Commission, and also by the technicians of the interests who oppose the project; that as a preliminary to any further investigation, an engineering study should be made of the proposed cut-off, accompanied by a firm estimate of cost and a report indicating its engineering feasibility; that a large number of experts in shipping matters be called to inform the Commission whether sea-borne commerce will or will not use this waterway without breaking bulk; and that a preliminary to any further discussion be the formulation of a decision concerning the imposition of tolls, since, without that, it is totally impossible to consider the true advantage to any interest of the construction of this cut-off."

L. G. Morphy

Mr. Morphy, General Superintendent and Chief Engineer of the Rutland Railroad, was recalled to supply information previously asked for as to the price or market quotations of the stocks and bonds of the Rutland Railroad, and also as to the taxes paid by the railroads of Vermont to that State or its municipalities in 1934.

Frank S. Davis

Mr. Davis, Manager of the Maritime Association of the Boston Chamber of Commerce, explained that his Association was a voluntary body of

about two hundred members, including representatives of the steamship lines serving the Port of Boston and other New England ports. Its principal object was to protect and promote the maritime interests of the Port of Boston and New England generally.

Great Lakes-Tidewater Service.—Speaking of transportation by water between New England ports and the Great Lakes, he said that in 1934 Boston had an all-water service by way of the St. Lawrence to Great Lakes ports, and the rates were substantially lower than rail rates, but after a trial of several months the service was discontinued because it did not pay, it was not patronized. Also western New England had had all-water service to Hudson River points but it had gradualy gone out of existence. For several years regular all-water package freight service was maintained from New York to ports on the Great Lakes, but this too was dropped on account of lack of business. At the present time, Diesel boats with a capacity of about 2,500 tons were bringing occasional cargoes to Boston by way of the Hudson and the Cape Cod canal.

In response to later questions by Mr. Keiser, Mr. Davis emphasized the fact that the existing traffic was a tramp service, quite different from the regular package freight service that was maintained for some time in the past.

Coastwise Traffic.—Mr. Davis also testified as to the character of the coastwise commerce of the Port of Boston. "Very little" he said "of the coastwise commerce now being received at the port could possibly be transported as economically as it is now being done, through the Lakes and over the Champlain Canal." He also drew attention to the fact that under the Coastwise law of the United States, traffic from Great Lakes ports to New England ports would be rigidly confined to vessels sailing under the American flag.

Regulating Competitive Transportation.—Mr. Davis referred to the large percentage of the traffic that reached Boston that was handled by motor truck, and he added, "We believe the public interest will be best served—and this applies to the Boston Chamber of Commerce as well as to the Maritime Association—if all forms of competitive transportation are regulated, and personally I consider it inevitable. We have all seen the Motor Truck Act in effect; the Water Carrier Act is before Congress. Inter-coastal rates, port to port, are already regulated. They must file with the new Maritime Authority the rates actually charged. Joint rail and water rates are now, and so far as I know always have been, subject to Interstate Commerce Commission regulation."

J. L. Carson

Mr. Carson said that he was the President of the Montreal Board of Trade, and represented that Board at the hearing. The Board felt that the proposed waterway should be considered from three main angles; its cost, its necessity, its effect. As to the former, they felt that, though no estimates had yet been submitted, the waterway would cost a very large sum of money. As to its necessity, the territory adjacent to the route was already adequately served by various forms of transportation, none of which was used to nearly its capacity. As to its effect, it seemed evident that the proposed waterway, if it was successful, would be injurious to existing modes of transportation, and notably to the railways, which were already suffering from lack of traffic, and further it would add to the already heavy burden carried by Canadian taxpayers. The Board of Trade asked permission to make further representations at a later date, when engineering data would be available.

George P. Lord

Captain Lord appeared on behalf of the Boston Port Authority, the purpose of which was to investigate all matters relating to the Port. He made the following statement as to the views of the Port Authority:

"The Port Authority of Boston has taken the position in this and in any investigation, that they are opposed to any proposition which might in any way relieve any traffic or take away any traffic from the railroads serving the Port of Boston. The Ports of Boston and Portland and other New England ports are all fed by railroads. We acknowledge that. Also the rails serve the ports. In other words, the rails take the cargo from the port and distribute it to the hinterland. It is our belief that any proposition which might in any way affect the tonnage carried by these rails would seriously affect the Port of Boston."

Gerret Fort

Mr. Fort testified on behalf of the Boston and Maine Railroad and also the Maine Central Railroad. He opposed the construction of the proposed deep waterway, he said, because there were already adequate transportation facilities to handle an increase of several hundred per cent. One of two things would happen: either the canal would be a failure—and that was his personal belief—in which case it would simply be a burden on the taxpayers; or, if it were a success, it would take away from the railroads of New England a business they were in no position to lose, and would in a relatively short time make those railroads a burden on the people of the United States.

Boston and Maine Railroad.—Mr. Fort gave the Commission particulars as to the physical situation of the Boston and Maine Railroad and its present financial standing. Conditions as to the movement of grain to the Atlantic seaboard had radically changed since the St. Lawrence waterway was investigated and reported upon. At that time there was a very real need for better transportation facilities for the movement of grain to the seaboard. The railroads were short of equipment and there was a large demand for export grain. To-day, there was no car shortage and the export market for grain had disappeared. They were actually importing Argentine grain through the Port of Boston.

Voorhees Exhibits

Mr. Frederick L. Wheeler filed Voorhees Exhibits No. 3 and No. 4, the former showing relation of tonnage of grain, iron ore and coal to total shipments through canals at Sault Ste. Marie, 1926-35 inclusive, and the latter a statement showing waterway mileages via various routes.

C. I. Johnson

Mr. Johnson, Assistant General Freight Agent of the New York Central Railroad, made a statement as to canal rates and their effect on the lowering of railroad rates. "There had been instances" he said "where rail carriers had attempted to regain certain kinds of commodities that were being transported by canal, under the authority of the Interstate Commerce Commission." He gave notable examples of the efforts of the railways to meet water competition, in such commodities as crude sulphur, rags and paper stock, bulk salt, plaster, sugar.

Automobile Shipments.—In regard to the statement that had been made at an earlier hearing that a considerable tonnage of automobiles would be available for transportation from Detroit by the proposed waterway to New York and adjacent points, Mr. Johnson said: "It is fair to presume that the transportation of automobiles through the Welland Canal, thence by Lake Ontario and the St. Lawrence River, and the proposed waterway from Montreal to the Hudson and New York would be practically nil." His evidence professed to show that approximately 125,000 automobiles built by General Motors were handled by boat to Buffalo and were distributed thence usually by truck to destinations in the east.

Mr. Johnson filed an exhibit showing the rates on grain in carloads from Buffalo to New York in 1936; also an exhibit showing ex-lake arrivals of grain at New York, by rail from Buffalo and a small amount from Erie, Pennsylvania, from 95 per cent to 98 per cent for export, in 1936.

W. W. Boyd

Mr. Boyd appeared on behalf of the Canadian National Railways and said that they would like to be put on record as opposed to the waterway. They asked the privilege of filing a brief at some later time.

George A. Walker

Mr. Walker appeared on behalf of the Canadian Pacific Railway Company and testified that his Company opposed the project. From a Canadian standpoint, he said, there were some considerations that should be kept steadily in view. Within the last fifteen or twenty years there had been a violent change in the whole transportation system of Canada. The development of the Port of Vancouver, with its expensive terminal facilities, had had the effect of diverting almost the whole of the import and export traffic of Alberta, and one-half Saskatchewan, through the Port of Vancouver. Also the people of Canada had spent $50,000,000 in developing the Hudson Bay Railroad and the Port of Churchill. Within the last twenty years the people of this country had acquired the Canadian National Railways, a system of 27,000 miles, equipped, like its competitor the Canadian Pacific, to handle three or four times the tonnage at present available.

"I suggest that in these circumstances, the time is not opportune to consider the expenditure of possibly hundreds of millions of dollars in the development of additional transportation facilities, particularly having regard to the condition of the Canadian National Railways, the operation of which results each year in a very heavy loss to the country." He also asked permission to file a brief.

J. E. Lareau

Mr. Lareau, representing four County Councils in the Richelieu Valley of Quebec, explained the interests of the people for whom he appeared in obtaining better water transportation. What they had in mind was a 12-foot waterway.

Seraphim Ouimet

Mr. Ouimet, consulting engineer of Montreal, spoke on behalf of the construction of a deep waterway from Montreal to New York, which he believed would be in the best interests of the people of Montreal.

BOSTON

The Commission held a public hearing in the City of Boston, Mass., on April 1st and 2nd, 1937.

Frank S. Davis

Mr. Davis, who testified at Montreal, again appeared in opposition to the proposed seaway, on behalf of the Boston Chamber of Commerce, the Maritime Association of the same Chamber, the Atlantic Deeper Waterways Association and the National Rivers and Harbors Congress.

Maritime Association

Mr. Davis read the following resolution: "Resolved: That the Maritime Association of the Boston Chamber of Commerce is opposed to the St. Lawrence-Champlain-Hudson waterway for many reasons including:

(1) That it is admittedly supplementary to, and contingent upon, the carrying out of the St. Lawrence project.
(2) That the enormous cost (estimated from $100,000,000 to $200,000,000) would impose tremendous taxes upon the country.
(3) That it would isolate Boston and practically all other New England ports and would prevent their participation in commerce to and from interior United States and Canadian points.
(4) That it would be disastrous to New England's railroads.
(5) That there is no economic justification for such deep waterway from the standpoint of either navigation or power requirements.
(6) That the injury it would inflict upon New England would far outweigh any possible benefits to the country as a whole."

Atlantic Deeper Waterways Association

On behalf of the Atlantic Deeper Waterways Association, Mr. Davis submitted the following statement by Mr. J. Hampton Moore, its President:

> "As you are doubtless aware, no definite action on this project has been taken by the Atlantic Deeper Waterways Association, although it has passed resolutions protesting against the ratification of the Great Lakes-St. Lawrence Treaty.
>
> "While I cannot speak officially for the Association, therefore, I can state that if the Montreal-Lake Champlain-Hudson River waterway project is related to or in furtherance of the St. Lawrence project as submitted for ratification by the United States Senate, this Association would be opposed to it. We have representatives, as you know, from all the Atlantic coastal states, and they by resolution have placed their reliance upon the existing New York State Barge canal for waterway contact between the Atlantic and the Great Lakes. Important waterway projects capable of serving large commercial and industrial interests within the United States are still awaiting the approval of Congress, including an enlarged New York State Barge canal. Our Association, I take it, would approve the attitude of the New York and Boston Chambers of Commerce on the Montreal-Lake Champlain project."

Mr. Davis submitted a number of reasons in support of the Resolution of the Maritime Association of the Boston Chamber of Commerce, and filed as Exhibits copy of a circular issued by the Champlain Valley Council and an extract from the record of the annual meeting of the Council of States of the Great Lakes-St. Lawrence Tidewater Association, held March 12, 1932.

Foreign Coal Competition.—Discussing the argument advanced by proponents of the waterway that it would involve cheap transportation for coal, Mr. Davis argued rather that should the Great Lakes be made accessible to deep-draft ocean freighters, foreign coal in foreign vessels would be more likely to displace coal produced in American mines by American miners and transported by American railroads and American vessels, and this disability would apply also to Canadian miners and transportation facilities. Mr. Davis supported his contention with an Exhibit in the form of a tabulation showing imports of foreign coal at Boston during the past five years.

All-Water Service.—Mr. Davis enlarged upon his previous evidence in Montreal as to existing all-water transportation between the Great Lakes and the Atlantic seaboard. He added: "The fact is there is no demand on the part of New England industries for an all-water service to Great Lakes ports by way of any of the existing all-water routes because the principal requirement of the industries is prompt deliveries of their manufactured products to the markets of the west. The New England railroads and their connections have kept abreast with this demand of the New England industries for prompt deliveries and have steadily improved their service on less than car-load package freight from New England points of origin to western destinations by way of both standard and differential routes through Canada."

Mr. Davis illustrated the progress that had been made by New England railroads in the way of ensuring more prompt deliveries of New England manufactured products in the west during the past fifteen years, by filing a statement with the Commission. He also filed a statement showing the distances between European ports and Great Lakes ports by the Gulf of St. Lawrence and by the Champlain cut-off.

South American Trade.—While admitting that there might be a slight difference in distance to the advantage of the Lake Champlain route in sailing from Montreal to the east coast of South America, Mr. Davis did not believe that operators of freight vessels would consider this saving in distance sufficiently important to offset the loss of speed in sailing through restricted channels. "The scope of the territory" he said "in which it could reasonably be hoped to develop any considerable volume of traffic for the Champlain cut-off route to and from Great Lakes ports, would be domestic commerce along the eastern seaboard, the Gulf of Mexico, the Pacific Coast and contiguous foreign territories. Such traffic, if moved in foreign vessels through the Champlain cut-off, could only be drawn to a large extent, if not entirely, from existing transportation facilities such as railroads, present waterway routes, highways and the merchant marine of Canada and the United States."

R. F. Bohman

Mr. Bohman, President of the New England Traffic League, said that it was a voluntary unincorporated organization of approximately two hundred industrial traffic managers representing firms, industries, chambers of commerce and other trade bodies throughout the six New England states.

"The League" he said "is diametrically opposed to the proposition here under investigation on the ground that it is not economically sound and that there is sufficient transportation facilities available to take care of New England's requirements for some time to come. The League does not look with favor upon subsidized transportation. It believes that all forms of transportation should stand on their own feet. Experience has taught us that, generally speaking, inland waterways do not stand on their own feet, and that the taxpayers' money is used for the benefit of the few."

Herbert L. Hammond

Mr. Hammond, Chairman of the Transportation Committee of the Boston Grain and Flour Exchange, said that the proposed waterway had been considered by his organization and that at a meeting of the Board of Directors held on March 27, 1937, it was unanimously voted that the Board of Directors be recorded in opposition to the St. Lawrence-Champlain deep waterway project.

Speaking for his own firm, the Charles M. Cox Company, dealers in grain and grain products, Mr. Hammond said that they had two plants in Vermont, one at St. Albans and the other at Brattleboro. It would not be any advantage to his firm to have bulk grain shipped by an all-water route to any point on the proposed cut-off. No method had been devised for delivering grain and feeds economically at points scattered throughout New England except by rail in car-load lots. Speed and certainty of time of arrival were also important factors in his business. A slow service by water would be of little value in supplying the needs of New England millers, distributors and consumers.

James H. McCann

Mr. McCann, Transportation Manager of the Associated Industries of Massachusetts, a state-wide organization with approximately one thousand members representing about 70 per cent of the industries of Massachusetts, said that the organization had voted in opposition to the proposed waterway. "It is generally recognized" he said "that the transportation problem confronting every section of the country to-day is a complex one, and the task is to find the proper place for each of the various agencies. What is needed and desired is the most efficient use of the available facilities at the lowest possible cost to the public. These facilities at present are in excess of the demand. A stupendous task is now facing the rail lines, the motor carriers, the regulatory agencies and the public in the administration of the federal and state laws pertaining to transportation by railroad and by motor vehicles. If further legislation is enacted with respect to water carriers the problem will become still more serious and difficult to solve. In the light of these conditions any investment in new transportation facilities is a matter of considerable importance. Especially is this true if the investment is one of public funds. These facts alone in our judgment justify our opposition to the proposed project. . . . Neither the actual nor the potential traffic moving between the east and the west warrants the expenditure of public funds for a project of this kind. We believe it unwise, unnecessary and unwarranted."

George P. Lord

Captain Lord, representing the Boston Port Authority, enlarged upon the evidence he had already given at the Montreal hearing, with particular reference to vessel operation over such a waterway as was under investigation. He testified as to improvements to the Port of Boston, noting in particular that Massachusetts had spent approximately $23,000,000 to develop the port.

Ocean-going Ships in Restricted Channels.—Discussing the practical operation of such a waterway, Captain Lord explained why, in his opinion, it was not practicable for ocean-going ships to use such restricted channels. He mentioned that the maximum speeds for such deep canals as the Suez, Panama, Amsterdam and Kiel ranged from four to six knots. In the Houston Ship canal it took twelve hours to cover the distance of 58 miles from Bolivar Roads to the turning basin at Houston. He filed a table showing the distances from Montreal to various points on the Atlantic coast, the English channel, Mediterranean entrance, South America and the Panama Canal. The Corinth Canal across

Greece was 26¼ feet deep and four miles long. It was a sea-level canal and involved a saving of 202 miles as compared with the sea route between Venice and Constantinople. That canal had been substantially a failure, owing mainly to the preference of larger ships for the old open sea route.

Dudley Harmon

Mr. Harmon, Executive Vice-President of the New England Council of the Agricultural, Commercial and Industrial Interests of New England said that the Council had been organized in 1925 under the joint auspices of the Governors of the New England States for the purpose of giving to New England a regional organization that would serve this area in a research and development capacity, and also as a stimulating body and a co-ordinating agency with respect to economic problems common to these six states.

New England Council

They had been asked to consider the matter of a waterway by way of the Champlain-Hudson River by its proponents in Vermont. The matter was referred to the State Council in Vermont, who reported that so far as they were informed they did not think the project commanded the interest or the support of the general business communities in their State. Further investigation brought out the fact that associates in other New England states had reached the opinion that the project, from a New England standpoint, was neither necessary nor desirable, and they did not feel that it was economically justified. The New England Council itself had decided that it was not in favour of the waterway. The Council was generally representative of New England business communities. The New England railroads and oil companies, in fact all the major industries, supported the Council.

John J. Halloran

Mr. Halloran said he was Vice-President and General Manager of C. H. Sprague and Son, which operated a regular cargo service between Boston and other Atlantic ports and the east coast of South America. Of the total general cargo in 1936, of 225,000 tons, his firm handled fifty-two per cent. In his view, to extend the navigable waterway from the Hudson through Lake Champlain to Montreal would mean that much cargo would be diverted from ports on the Atlantic coast, and particularly from the Port of Boston and other New England ports. He believed that because of the nature of the navigation through these narrow waterways, it would be slow and hazardous and would prove expensive, and in the end unwarranted. He would be reluctant to send his steamers up through such a waterway. Small foreign cargo vessels might take advantage of such a waterway.

Arthur Lane

Mr. Lane, President of Peabody and Lane of Boston, said that their business was to act as agent for regular freight steamship services operating both foreign and domestic, and to secure freight cargoes for their vessels.

His position was that they were strongly opposed to the St. Lawrence-Champlain-Hudson River waterway project, first, because of the tremendous cost, which he did not think would be justified, and certainly the people of this territory should not be assessed taxes for a project which would not be of benefit to them and would work to their detriment; also because ships and their cargoes would be diverted from Boston, and they would be either transshipped from New York to Canada and the west, or the ships would proceed on through this waterway to the west.

All-Water Services.—Mr. Lane confirmed statements previously made as to all-water services between New England ports and the Great Lakes by way of the Gulf of St. Lawrence. His firm had acted as agents for three vessels that ran a service every two weeks and subsequently reduced to one month. The line had discontinued because it had proved unprofitable, partly because of the limited draft and the consequently limited cargo, and also because the business going from Boston was of such a high class that it was adversely affected by the slow transit.

J. B. Leonard

Mr. Leonard, President of the Foreign Commerce Club of Boston, said that it had a total membership of about 250, comprising every phase of waterfront enterprise, steamship operation, steamship agencies, warehousing, terminal operation facilities, tow-boating and so forth. He had been asked to appear before the Commission to record the Club as opposed to the waterway. It would seem to them that the plan contemplated would tend further to impair the efficiency and to add to the handicap already suffered by the railroads serving New England territory.

Preferential Tariffs.—He described the efforts of the Foreign Commerce Club to correct a situation from which the Port of Boston suffered, in connection with the preferential clause in the Canadian tariff under which goods of British origin imported into Canada were entitled to the preferential duty only when they were shipped direct from a British country of origin to a river, sea or lake port of Canada, or via another British port. Prior to the preference such cargoes would be discharged at Boston. "It is conceivable," he said, "that under the plan proposed the Port of Boston would find itself in a position where it would lose tonnage by diversion to Montreal and transshipment to New England points from that port."

Arthur H. Ferguson

Mr. Ferguson stated that he was Manager of the Bureau of Transportation and Public Service of the New Bedford Board of Commerce. It was the view of the Board that both the St. Lawrence Deep Waterway and the St. Lawrence-Hudson project should be opposed. The reasons underlying the Board's action were: "First. Conditions have so changed since the larger project was submitted to the International Joint Commission that there is no longer any possibility for the development of adequate tonnage of export and import products via an improved St. Lawrence waterway, and moreover an adequate use of the proposed improved waterway via the Lake Champlain route cannot be proven to the satisfaction of unbiased and interested parties.

"Second. The construction of any one or both of these tremendously expensive waterway projects would be most detrimental to the interests of New England and its people, and their financial participation therein through federal taxation should not be forced by the proposed treaty between Canada and the United States."

Gerret Fort

Mr. Fort, who testified at Montreal on behalf of the Boston and Maine Railroad, gave evidence on behalf of the Maine Central Railroad. The Maine Central believed that the proposed waterway was without economic justification; that its effect, if completed, would be to deprive the New England railroads of a business they could ill afford to lose. It would mean one of two things: either the New England railroads would go into liquidation, or the rates would have to be raised considerably above what they were to-day.

Personally Mr. Fort did not believe there would be any material diversion of traffic from the railroad. "It is a waste of public funds to build this canal because there would be no business for it after its construction."

George H. Fernald, Jr.

Mr. Fernald, as Counsel for the Boston and Albany Railroad, expressed the view that the proponents of the waterway had grossly exaggerated the prospective traffic. "But," he added, "if the proponents of this measure are anywhere near right and a considerable amount of tonnage is to be handled, then we will be in a position during seven or eight months of the year of having a considerable portion of traffic diverted from the Boston and Albany Railroad, because if the Port of Boston is affected, we are affected. Our interests tie up with the Port of Boston. The time of year when our traffic will be diverted by this waterway is the time of year when operating conditions are the best, during the spring, summer and fall."

Demand for Fast Service.—Mr. Fernald was in agreement with the view expressed by previous witnesses that the principal requirements of industries located on railroads was fast service for their manufactured products in less than carload lots. "I have been in the railroad business for quite a while," he said. "When I first came with the railroad it did not make much difference whether a shipment got here in three days or ten days. Now the railroad service and the truck service is so speedy that is is a matter of hours with the railroads in competing with other forms of transportation."

James E. McGrath

Mr. McGrath, Assistant to the General Traffic Manager, New York, New Haven and Hartford Railroad Company, said that his railroad was opposed to the construction of the Montreal-Champlain-Hudson waterway for the following reasons:

(1) We believe if constructed it will deprive the New England railroads of a substantial amount of business which they cannot afford to lose.
(2) We believe the economic need for this seaway does not exist, and if constructed it will be a burden upon the taxpayers of the country.
(3) The New England railroads and employees represent a very substantial source of tax revenue, and their tax money should not be used by the Government to deprive them of a livelihood.
(4) We object to its construction on any other basis than that tolls sufficient to pay cost of operation, upkeep and interest, and amortization of original investment will be charged to those making use of it.
(5) This seaway, if constructed, can operate only a portion of each year, and, therefore, will not meet the transportation needs of the section it serves; yet it will deplete the freight business and earnings of the railroads whose improved service has had an important part in the development of industry. The railroads with present facilities are able to care for a substantial increase in business over the entire year."

Mr. McGrath went into some detail in the matter of improved service to show that the railroads had really spent a lot of money in order to give the industries the quick service they needed.

John T. Corbett

Mr. Corbett, representing the Brotherhood of Locomotive Engineers, Washington, D.C., said that his organization was opposed to all subsidies to such waterways as that under consideration. They recognized that there were certain natural waterways, with what might be termed natural harbours along

them, that were entitled to assistance. He challenged the statement that the railroads had received subsidies. What they got was land grants and there was a *quid pro quo* arrangement in connection with these grants by which it was agreed that the mail should be carried for nothing and that practically all government troops and government material should be carried at about one-half the rate that was given the ordinary user. This was found to be impracticable and the arrangement was changed so that mail was carried on a land grant railroad for about 80 per cent of what it would be on the non-land grant railroad.

Criticizing the Champlain project, Mr. Corbett said, "You can build a double-track railroad over the Lake Champlain route from New York to Montreal, probably with ferries to get it across the river, cheaper than you can do it this way. If it is cheaper transportation you want and you wish to subsidize a transportation route, why not give it to somebody who can handle it and do it for twelve months in the year"?

Henry A. Twichell

Mr. Twichell appeared as General Chairman of the Brotherhood of Locomotive Engineers, Boston and Maine Railroad, and Chairman of the Eastern General Chairmen's Association, comprising territory east of Chicago and north of the Mason and Dixon line. "There are" he said "three reasons why we believe that this Commission should give careful consideration before approving the expenditure of a large amount of money to make this inland waterway navigable for transportation purposes.

"First: the necessity of such a form of transportation. We believe that there is at the present time adequate, efficient, and economical transportation to take care of the present or any future business that may develop over this territory.

"Second: the effect of such a waterway. At the present time we have several thousand locomotive engineers back firing locomotives, and there are many more who are laid off on account of insufficient business of the railroads to keep them employed. To establish additional transportation facilities will increase the number of locomotive engineers to the unemployed ranks to a large extent.

"Third: the cost of promoting, maintaining and equipping such a project would require an enormous expenditure of the taxpayers' money, of which the locomotive engineers can be included in that class, and thereby requiring them as well as the railroads to pay an exhorbitant tax to assist in subsidizing a competitive form of transportation."

Transportation Association, etc.

Mr. Frederick L. Wheeler filed an Exhibit on behalf of the Associated Railroads of New York, showing the par value of the stock, the authorized outstanding amount as of December 1, 1935, the dividends if any paid from 1926 to 1935, and the various classifications of stock. Mr. Wheeler also filed a statement prepared by the Transportation Association of America showing the distribution of freight traffic by the railroads, water carriers, pipe lines, motor trucks and electric railways for the years 1925 to 1935, also the ton mileage handled by each of these facilities and the percentage.

Resolutions.—Mr. Wheeler filed Resolutions adopted by the Attica, N.Y. Chamber of Commerce, the Binghamton Chamber of Commerce, the Chenango County Board of Supervisors, the Board of Supervisors of Delaware County, the Dunkirk Chamber of Commerce, the Elmira Traffic Club, the Elmira Association of Commerce, the Geneva, N.Y. Chamber of Commerce, the Jamestown Chamber of Commerce, Lockport, N.Y. Chamber of Commerce, the

Madison County Board of Supervisors, the Middletown Chamber of Commerce, the Oneonta Chamber of Commerce, the County of Orange Board of Supervisors, the Staten Island Chamber of Commerce, the Board of Supervisors of the County of Sullivan, Utica Chamber of Commerce, the City of Brockton, Mass., Framingham Chamber of Commerce, Lawrence Chamber of Commerce, Dorchester Board of Trade, East Corinth, Maine, Board of Trade, Mechanic Falls Chamber of Commerce, the Millinocket Chamber of Commerce, Quincy Chamber of Commerce, Danvers Chamber of Commerce, the Boston Wool Trade Association, the Torrington, Conn., Chamber of Commerce, all in opposition to the proposed waterway.

Mr. Frank S. Davis asked permission to record Honorable George J. Bates, Member of Congress for Massachusetts, as opposed to the project; also filed resolutions in opposition from the Providence Chamber of Commerce, the Manufacturers' Association of Connecticut, the Chamber of Commerce of Fall River, Mass., the Chamber of Commerce at Lynn, Mass., and the Board of Trade at Needham, Mass.

Quinton Reynolds

Mr. Reynolds appeared on behalf of the Springfield, Mass., Chamber of Commerce. He said that the objections of the Chamber of Commerce to the development of the proposed seaway were based upon the knowledge that:—

"(1) The cost of either or both of these projects to the taxpayers of the country far out-weigh any advantages the taxpayers may gain from their completion.

"(2) Our present day economy makes us dependent upon year-round railroad service. To maintain their rights-of-way the railroads would have to increase their rates sufficiently to offset the losses resulting from deflection of traffic during the five or six months when the waterways would be open to assure our community service during the six or seven months when the seaways would be closed.

"(3) Such developments are unfair to investors, their employees and taxpayers generally.

"We oppose all such developments until plans for their construction and maintenance include provisions assuring the public that the cost of said construction and maintenance will be borne by those who use the facilities."

Harry Wilson

Mr. Wilson, Vice-Chairman, Traffic Executive Association of the Eastern Territory, composed of representatives of the railroads operating in the New England Trunk Line and Central Freight Association territory, explained that that region was part of the country lying north of the Ohio River and in a general way north of the Potomac, including the States of Illinois and Michigan and all States east thereof.

Potential Tonnage.—Mr. Wilson discussed what he understood to be the claim of the proponents that the waterway would furnish means for a potential tonnage of 12,000,000, and a saving in transportation costs of about $100,000,000. In the first place, he said, there was no tangible ground for the estimate of 12,000,000 tons. An estimate more nearly correct would be found in Appendix C to the Brief of the Associated Railroads of New York, which suggested a total of 2,242,600 tons. He believed that even this over-stated the potential tonnage, unless he were to assume that the purpose of the new canal was to take over the business now handled by the New York State Barge canal.

The claims of proponents, he said, seemed to be based on what the present rates of transportation were by existing routes and what the cost would be via

the proposed route. "There is no reason to believe that the operators of boats through the proposed canal would not charge as high rates as they could obtain in competition with existing routes."

Transportation Costs.—He assumed also that whatever tonnage via the Champlain canal might be, it would not by any means all move the maximum distance, New York to Duluth, and to the extent that it moved shorter distances, the spread in rate via that route and the now existing route, would be less. He concluded therefore that the argument that the transportation cost would be $100,000,000 less via the proposed route, was not based on anything tangible. Analyzing the situation, he came to the conclusion that instead of a transportation cost of $100,000,000 less than at present, or an average of 41·6 cents per hundred pounds less than via existing routes, it would probably be less than ten per cent of that figure, that is less than $10,000,000.

Again, he said, the estimates of proponents were based apparently on the belief that the new waterway would get all of the tonnage now carried on existing routes, rail and water. It could not, however, be expected that the present routes would sit idly by and permit a diversion of traffic from them without a fight. The result would be unreasonably low rates and a sacrifice of all or part of the profits from all carriers concerned. There were ample transportation facilities now. To establish the new route would not create any new business, but such traffic as was handled would be taken from existing routes.

Existing Facilities Adequate.—In answer to a question as to whether or not he saw any justification for the proposed waterway from an economic standpoint, Mr. Wilson said: "I see none whatever. The waterway would almost parallel the New York State Barge canal. The New York State Barge canal handled last year—it was the peak year of its existence—five million tons of freight. The man who is responsible for running it, and who is employed by the New York State Government, says they need twenty million tons to justify the expense. They have only 25 per cent of that now. Any figures that I have seen indicating the amount of business that might be expected for the canal are based absolutely on theories. They are just picked out of the air. There is no ground for them at all. Nobody knows, as a matter of fact, what will be handled, but you can get at it closer than what has been estimated by taking what is available. That has not been done. It is all based on theory. Somebody estimated the figures he wanted to use."

Harold E. Kimball

Mr. Kimball, Traffic Manager for the Port of Portland, Maine, said that the Maine State Chamber of Commerce, the City of Portland and the Port of Portland Authority wished to vigorously oppose the construction of a deep waterway from Montreal through Lake Champlain to the Hudson for the following reasons:—

"(1) It is difficult to consider the project of a waterway from Montreal through Lake Champlain to connect with the Hudson River apart from the Great Lakes-St. Lawrence seaway, and it is felt therefore that consideration of the Champlain-Hudson waterway is premature in view of the present status of the Great Lakes-St. Lawrence waterway treaty. In view of our consistent opposition to the Great Lakes-St. Lawrence deep waterway project, we are more strongly opposed to the Champlain-Hudson proposal in ratio to the additional cost of the latter project which must be added to the cost of constructing the Great Lakes-St. Lawrence deep waterway in order to make the Champlain-Hudson cut-off at all feasible.

"(2) Existing available means of transportation between the City of Montreal and the City of New York have an excess capacity which should be more fully utilized before the creation of new avenues of commerce passing through the same territory.

"(3) No evidence has as yet come to our attention which in any sense justifies the construction of the so-called Champlain-Hudson cut-off from an economic angle.

"(4) Any doubtful benefits which might accrue to interests represented by proponents of this waterway would not offset the sacrifice which New England ports and transportation agencies, existing by reason of very substantial investments of private capital and public funds, would have to make through loss of traffic plus increased costs, represented by their share in the burden which would be thrown upon all sections of the country to pay for the construction of the proposed project."

Michael O'Leary

Mr. O'Leary expressed the opposition of the South Boston Citizens Association to the proposed waterway.

APPENDIX

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APPENDIX

1. Report of Engineers.
2. St. Lawrence Waterways: Summary of Reports.
3. St. Lawrence Treaty, 1932.

I

REPORT OF ENGINEERS TO INTERNATIONAL JOINT COMMISSION

March 15, 1937.

The International Joint Commission,
Washington, D.C., Ottawa, Ontario.

GENTLEMEN,—On January 6, 1936, the Chief of Engineers, United States Army, assigned the District Engineer, First New York District, United States Engineer Office, to assist the Commission in its investigation of a waterway from Montreal through Lake Champlain to connect with the Hudson River. The present District Engineer is Colonel E. L. Daley, Corps of Engineers, United States Army. On March 31, 1936, the Government of Canada designated Mr. Guy A. Lindsay of the Department of Railways and Canals to assist the Commission in its investigation. On April 3, 1936, Mr. J. L. Dansereau of the Department of Public Works of Canada was designated to represent that department in connection with the investigation.

The undersigned have the honour to submit this report pursuant to the above authority and in compliance with instructions received from you as follows:—

> "In the matter of the Champlain Waterway Investigation, we are instructed to request you to submit your report to the Commission not later than March 15 next. In this report, will you be good enough to include estimates of the cost of a 27-foot channel (with depth of 30 feet for all lock sills in order to conform to the locks in the proposed St. Lawrence Waterway) on all the proposed routes between the St. Lawrence River and the Hudson River and also estimates of the cost of a 14-foot channel and a 12-foot channel on whatever route you may consider the most economical.
>
> "Will you also please embody in your report such data as may be available in regard to possible tonnage on the projected waterway and such other data as you may think of value to the Commission."

SYLLABUS

The construction of a waterway of 12-foot, 14-foot, or 27-foot depth from Montreal through Lake Champlain to connect with the Hudson River is feasible from an engineering standpoint.

For a depth of 12 or 14 feet, the most satisfactory route is from Montreal down the St. Lawrence River to Sorel; thence up the Richelieu River to Lake Champlain; thence through Lake Champlain, The Narrows, and the Champlain Division of the New York State Barge Canal; and thence down the upper Hudson River to Albany. From data at hand, lacking actual survey data, it is believed that the same route would be most satisfactory for construction of a 27-foot waterway.

The estimated capital cost and annual carrying charges for the construction of a 12-foot waterway are $12,884,000 and $953,000, respectively. The estimated maximum potential annual savings in transportation costs is $58,800.

The estimated capital cost and annual carrying charges for the construction of a 14-foot waterway are $50,006,000 and $2,738,600, respectively. The estimated maximum potential annual savings in transportation costs is $75,600.

The estimated capital cost and estimated annual carrying charges for the construction of a 27-foot waterway along this route are $342,205,000 and $17,646,400, respectively. The estimated maximum potential annual savings in transportation costs is $4,710,240.

EXISTING WATERWAYS

1. DESCRIPTION.—The various water routes from the Great Lakes and interior of the United States and Canada to the Atlantic seaboard are shown on plate No. 1 in Pocket. (See also charts Nos. 2, 3, 5, 7, 9, 11 to 16, 171 to 174, and 181 to 185, Survey of the Northern and Northwestern Lakes, issued by the War Department, United States, and charts Nos. 22, 25, 26, 49, 50 and 51, issued by the Canadian Hydrographic Service.).

2. The Great Lakes system consists of Lakes Superior, Michigan, Huron, Erie and Ontario, with Lake St. Clair and the various connecting rivers and straits. As the result of the construction of locks at Sault Ste. Marie by both the United States and the Dominion of Canada, the construction of the new Welland Ship Canal by Canada, and channel improvement at other critical points such as the Neebish channels in the St. Marys River and the Lime Kiln Crossing in the Detroit River, there is a minimum channel depth of between 20 and 21 feet below low-water datum throughout the Great Lakes system. As the result of these improvements and corresponding improvements to the harbours, the Great Lakes are now navigated by vessels having a carrying capacity of 10,000 to 15,000 tons and drawing 18 to 22 feet, depending on the stages of water levels. The total distance measured along the steamer track from Duluth to the outlet of Lake Ontario is 1,162 miles. Dimensions, elevations, and other descriptive details of each of the lakes and rivers are given in Tables I and II, Appendix A.

3. The St. Lawrence River, which is the outlet of the Great Lakes system, is navigable through improved natural channels for a distance of 68·3 miles from the lower end of Lake Ontario to the head of the Williamsburg Canals. A channel 26·5 feet deep with a minimum width of 450 feet, has been provided from Lake Ontario to Ogdensburg, N.Y., and Prescott, Ontario. Navigation from there to Montreal is carried through the Williamsburg Canals, the Cornwall Canal, Lake St. Francis, the Soulanges Canal, Lake St. Louis, the Lachine Canal, and intervening pools and improved natural channels of the river. The distance from Lake Ontario to Montreal is 181 miles and the controlling depth is 14 feet. The total distance by water from Duluth to Montreal is 1,343 miles. From Montreal to the Gulf of St. Lawrence, the Canadian Government is improving the natural channel of the St. Lawrence River to provide a depth of 35 feet at the adopted datum.

4. The Ottawa River from Ste. Anne, at the northwest end of Lake St. Louis, to Ottawa, Ontario, a distance of 94 miles, has been made navigable by the construction of the lock at Ste. Anne and the Carillon and Grenville Canals. The depth provided is 9 feet. By this route, the total distance from Ottawa to Montreal is 119 miles.

5. The Beauharnois power canal, 3,000 feet wide and 15·5 miles long, is situated on the south side of the St. Lawrence River between Lake St. Francis and Lake St. Louis. Provision has been made in the construction of this canal

for a navigation channel 600 feet wide and 27 feet deep which in the event of the future construction of the St. Lawrence Deep Waterway would become the link in that waterway between Lake St. Francis and Lake St. Louis.

6. Between the Great Lakes and the Hudson River lie two mountain masses, the Alleghany Plateau and the Catskill Mountains in the south, and the Adirondack Mountains in the north. The Green Mountains lie to the northeast of the Hudson. Between these mountain masses, two well-defined passes offer ways of communication. The eastern pass is occupied by Lake Champlain, the mean elevation of which is 95 feet above sea level, and Lake George, 322 feet above sea level, both of which drain to the north by the Richelieu River into the St. Lawrence River. The western pass includes the lower 100 miles of the valley of the Mohawk River and a large depressed area in which Oneida Lake lies.

7. Lake Champlain is 112 miles long by 9 miles wide at its widest point. The maximum and minimum elevations above sea level of Lake Champlain, at Rouses Point, recorded since 1890, are 101·3 (March 30, 1903) and 91·9 (November 13, 1908). The average elevation during this period was 95·14. High water usually occurs during the last half of April and low water during the last half of September. The outflow from Lake Champlain is controlled by the section of the Richelieu River at the head of St. Johns Rapids at St. Johns. During the period from 1890 to date, the outflow has varied from a maximum of 51,000 cubic feet per second to a minimum of 1,000 cubic feet per second. The average flow during this period was 11,000 cubic feet per second. The drainage and surface areas of the lake are as follows:—

	Drainage Area Sq. Miles	Surface Area Sq. Miles
In the United States	7,550	419
In Canada	* 504	17
Tota	*8,054	436

* The Richelieu river basin drains an additional 936 square miles. In the entire length of Lake Champlain, the controlling depth of water is 12 feet, the depths ranging from 12 to 30 feet for 42 miles and over 30 feet for 70 miles. A narrow arm 37 miles in length at the southern end of the lake, known as the "Narrows," varies from a few hundred feet to a mile in width, with controlling depth of 12 feet.

8. The Richelieu River, outlet of Lake Champlain, empties into the St. Lawrence River at Sorel, 46 miles below Montreal and 81 miles by river, north of the international boundary. The Richelieu River is navigable from the St. Lawrence River to the St. Ours Lock, a distance of 14 miles, with a depth of 12 feet. The St. Ours Lock is 339 feet long and 45 feet wide, with a depth of 12 feet over the sills. From this lock to Chambly, a distance of 32 miles, the river has a controlling depth of 7 feet and is at present being improved to 12 feet. The Chambly rapids, which extend from Chambly to St. Johns, are overcome by the Chambly Canal, 11·76 miles long. The canal has eight lift locks and one guard lock. The smallest lock is 120 feet long and 23 feet wide, with a depth of 6·5 feet over the sills. The total lift through the canal is 71·5 feet. The river is navigable from the Chambly Canal at St. Johns to the international boundary, a distance of 23 miles, with a depth of 7 feet. The total fall in the river at mean stage from Lake Champlain to the St. Lawrence River at Sorel is 80·3 feet. All bridges over the navigation channel through the Richelieu River and over the Chambly Canal are of a movable type with no restrictions as to vertical clearances.

9. Navigation is provided from the southern end of Lake Champlain to tide water of the Hudson River at Troy, N.Y., through the Champlain Division of the New York State Barge Canal from Whitehall to Waterford and the

canalized upper Hudson from Waterford to the United States Lock and Dam at Troy. The depth throughout this portion of the existing waterway is 12 feet. The tidal Hudson from Troy to Albany has been improved to provide a depth of 12 feet. From Albany to New York Harbor a depth of 27 feet and minimum width of 300 feet has been provided. The mean range of tide at the Troy Dam is 4·7 feet, at Albany 4·6 feet, and at the Battery, New York City, 4·4 feet.

10. Above the lock and dam at Troy, the area of the Hudson River drainage basin is about 9,900 square miles, of which the basin of the Mohawk River, main tributary of the Hudson, constitutes about 40 per cent. The discharge of the river above the Troy dam has been regulated since 1930 by two reservoirs operated by the Board of Hudson River Regulating District. One reservoir at Indian Lake, N.Y., is 134 miles above the Troy dam and the other, the Sacandaga reservoir at Conklingville, N.Y., is 77 miles above the Troy dam. These resorvoirs are regulated to provide a minimum flow of 3,000 second-feet at Spier Falls, 59 miles above Troy, and to reduce the peak flow during freshets. Before the construction of these regulating works, the discharge of the Hudson River varied between wide limits. Discharges as low as 1,500 second-feet and as high as 240,000 second-feet (in 1913) have been observed. The regulation of the Hudson River has been of benefit to navigation in the increased minimum rate of low-water flow in the reduced flood flow.

11. The Champlain Division of the New York State Barge Canal extends from the Hudson River at Waterford, 3 miles above the lock and dam at Troy, to Whitehall, N.Y., at the head of Lake Champlain, a distance of 60·4 miles; 36·8 miles of this canal are canalized Hudson River and 23·6 miles are a land cut through the divide between the Hudson River and Lake Champlain. From the pool formed by the lock and dam at Troy, the canal ascends by 8 locks to the summit level of 140 feet near Fort Edward and then descends by 3 locks to Lake Champlain. The depth of the barge canal is 12 feet below normal pool level. The width of the canal is 75 feet in earth sections, 94 feet in rock sections, and 200 feet in river sections. The locks are of uniform size, 310 feet long and 45 feet wide, with a depth of 12 feet over the sills. The minimum vertical clearance of the bridges spanning the canal is 15·5 feet above normal pool level.

12. The Erie Division of the New York State Barge Canal extends from Waterford to Tonawanda, N.Y., on the Niagara River, a distance of 338 miles. From Tonawanda to Lake Erie, via the Niagara River, the distance is 14·4 miles. A branch of the Barge Canal System known as the Oswego Canal extends from the Erie Canal at Three Rivers Point, just west of Lake Oneida, to Oswego at Lake Ontario, a distance of 23·8 miles. From the pool formed by the lock and dam at Troy, the Erie Canal ascends by 19 locks to the summit level of 420 feet near Rome; then descends by 3 locks to elevation 363 at Three Rivers Point; and then ascends by 12 locks to elevation 564·3 in the Niagara River. From elevation 363 at Three Rivers Point the Oswego Canal descends by 7 locks to elevation 244 at Lake Ontario. The Erie and Oswego divisions of the barge canal have the same dimensions as the Champlain division. The section of the canal extending from Waterford to Oswego, a distance of 184 miles, is now being improved further through funds supplied by the United States. The improvement involves an expenditure of $27,000,000 and consists of deepening the channel to 14 feet between locks, widening the channel progressively throughout, and raising all fixed bridges to a minimum vertical clearance of 20 feet above maximum navigable stage.

13. A summary of the channel and lock dimensions of the above-described existing waterways is given in Table III, Appendix A.

14. Other means of transportation paralleling the waterways described above include the New York Central, West Shore, Rutland, Central Vermont, and Delaware and Hudson Railroads in the United States, the Canadian Pacific and Canadian National Railways in Canada, and important trunk highways in both countries.

15. The principal United States and Canadian harbors of the Great Lakes have controlling depths at low water datum of from 16 to 28 feet. The more important of the harbors have depths of 21 feet or more. The depth of the harbor at Montreal varies from 32 to 35 feet. Harbors on Lake Champlain have depths varying from 8 to 12 feet. The depth of the harbor at Albany is 27 feet. The depth of the harbor at New York City varies from 30 to 40 feet.

16. The improvement of the St. Lawrence Waterway, as proposed by treaty, is a project for the improvement of navigation facilities from the head of the Great Lakes to Montreal and for the development of electrical power. The channels are to be 27 feet deep with a minimum width of 450 feet, except in canal sections, where the bottom width is to be 200 feet. From Lake Ontario to Montreal, there will be 9 locks each 859 feet long and 80 feet wide, with depth of 30 feet over the sills.

17. History of Construction.—The first work of interior waterway improvement in New York State was performed by a private company chartered in 1792. A portion of the Niagara-Oswego-Mohawk route, extending from Schenectady to Seneca Falls was opened to navigation for boats carrying 16 tons. Between 1812 and 1820 New York State purchased the charter and works and constructed various canals as follows:

(*a*) The original Erie Canal was begun in 1817 and completed in 1825. It had a bottom width of 26 feet and a depth of 4 feet. Between 1836 and 1862 the waterway was enlarged so as to provide bottom widths of 52·5 and 56 feet and a depth of 7 feet. A second enlargement to a depth of 9 feet was begun in 1896, but was completed only at disconnected localities.

(*b*) The original Champlain Canal was begun in 1817 and completed in 1823. It had a bottom width of 26 feet and a depth of 4 feet. In 1860 a bottom width of 35 feet and a depth of 5 feet were authorized. In 1870 the New York State legislature ordered a bottom width of 44 feet and a depth of 7 feet; this improvement was not completed.

(*c*) The original Oswego Canal, begun in 1825 and completed in 1828, had the same dimensions as the original Champlain Canal, namely, a bottom width of 26 feet and a depth of 4 feet. The first enlargement was started in 1852 and completed in 1862 and provided a channel of the same size as the Erie at that time, 52·5 by 7 feet. A second enlargement in 1876 was also similar to the Erie, a depth of 9 feet being attempted, but the work was never wholly completed.

18. In 1900, New York State appropriated $200,000 for a complete survey and estimate of cost of a new canal system, embracing the Erie, the Champlain, and the Oswego canals. The surveys, plans, and estimates were completed in 1901. In 1903 the people of the State voted favorably for the improvement. By another referendum vote in 1909, the Cayuga and Seneca branches were added to the system. The barge canals were opened to navigation in 1918 and a few years later were completed to a depth of 12 feet.

19. The Narrows of Lake Champlain from Whitehall, N.Y., to Benson Landing, Vt., a distance of 13·5 miles, has been under improvement by the United States since 1836. A channel 12 feet deep at low-lake level with a minimum width of 110 feet has been provided.

20. Before the improvement of the upper Hudson River was undertaken, the channel north of the town of New Baltimore as far as Troy, a distance of 21 miles, was exceedingly tortuous and unstable with a minimum depth of 4 feet at mean low water above Albany, and 7·5 feet below. Improvement was commenced by New York State in 1797. In 1831 jurisdiction over the Hudson River was assumed by the United States. From time to time, until 1890, the United States and the State of New York continued simultaneously to improve the river by dike construction and dredging. Since 1891 the United States alone has continued the improvement.

21. Canada first considered the necessity of providing a navigable route to connect the St. Lawrence River and Lake Champlain in 1812. After the commencement of construction by New York State of the Champlain Canal connecting Lake Champlain and the Hudson River in 1817, the Parliament of Lower Canada, in 1818, granted to a company the right to construct a canal to overcome the rapids between Chambly basin and St. Johns. This company made surveys but due to financial difficulties its charter lapsed and in 1823, after a Parliamentary investigation, an Act was passed authorizing the construction, under a Commission, of the Chambly Canal with locks 100 by 20 feet, with a depth of 5 feet. It was stipulated, however, that work was not to commence until the completion of the Lachine Canal from Montreal to Lake St. Louis, on the St. Lawrence River, then under construction.

22. The Commission was appointed in 1829 and was instructed to proceed with the construction of the necessary works to provide for navigation from the St. Lawrence River to the international boundary. Construction of the Chambly Canal was started in 1831 and carried on intermittently until 1843 when this portion of the system was placed in operation. The original project for navigation between Sorel and Chambly basin was to deepen the river by means of dredging and work on this project was carried on during 1830-31 and then abandoned. In 1835, the construction of the lock and dam at St. Ours was decided on and construction of these works was commenced in 1844 and completed in 1849. The lock at St. Ours as then constructed was 200 feet long by 45 feet wide with 7 feet depth of water.

23. In 1871, the "Canal Commission" appointed by the Canadian Government in the previous year to report "as to the best means of affording such access to the sea board as may best be calculated to attract a large and yearly increasing share of the trade of the North Western portion of North America through Canadian Waters" recommended the early enlargement of the Richelieu River Canal system to a depth of 9 feet with locks 200 feet long and 45 feet wide. No action was taken on this recommendation.

24. From 1928 to 1930, the navigation channel in Richelieu River between Sorel and St. Ours was deepened to 12 feet. In 1930 work was commenced on the construction of a new lock at St. Ours, 339 feet long and 45 feet wide, with a depth of 12 feet over the sills. This lock was completed in 1933.

25. The construction of a regulating dam in the river between St. Johns and Fryers Island, 8 miles below, has been proposed several times since 1900, both as a means for preventing damages caused to riparian owners by flooding at periods of extreme high water on Lake Champlain and as a means to increase the low-water flow for the purposes of power development. The Canadian Government has appropriated funds to construct a dam designed to accomplish the first-mentioned purpose.

26. Bridges.—Spanning the existing waterways between New York City and Sorel, Quebec, are 67 bridges. Details of the types, clearances, etc., of these bridges are shown in Table IV, Appendix A.

27. The construction of a deep waterway from the St. Lawrence River to the Hudson River at Albany would necessitate the reconstruction of the 13 existing bridges spanning the Hudson River north of the Troy-Cohoes highway bridge at Troy, N.Y., to Fort Edward, all of the bridges (19) spanning the Barge Canal between Fort Edward and Whitehall, and the bridge crossing Lake Champlain at Crown Point. From the northern end of Lake Champlain to the St. Lawrence River the construction or reconstruction of from 7 to 23 highway and railroad bridges would be required, the exact number depending on the route selected.

28. VESSEL TRAFFIC.—The carriers of water-borne commerce on the Great Lakes may be divided into three types: the bulk freighter, package freighter, and car ferry. Bulk cargoes, including iron ore, grain, limestone, coal, and oil, account for more than 90 per cent of the total movement of freight on the Great Lakes. The modern bulk freighter has a length of 600 feet, a beam of 60 feet, and with a loaded draft of 22 feet carries from 12,000 to 15,000 tons of cargo. Several of the bulk carriers have a system of hopper-bottom holds and conveyors which permits unloading with no outside assistance. These latter vessels are engaged chiefly in the limestone trade but have been used for delivery of coal to wharves not provided with unloading machinery. Oil in bulk is carried in tankers, equipped with pumps and pipes for loading and discharging. Some of the tankers are of a size that permits them to operate on the New York State barge canal system and the St. Lawrence canals. The lumber trade of the Great Lakes is carried in a nearly obsolete type of wood vessel.

29. The vessels used for carriage of package freight on the Great Lakes are less standardized than those used for bulk freight. Double-deck vessels from 350 to 450 feet in length, 45 to 50 feet in beam, and draft of 18 to 20 feet are used. Loading and discharging is carried on through side ports loading into the 'tween deck spaces. Many of these ships also have a large deck house providing refrigeration space for transporting dairy products.

30. Car ferries used on the Great Lakes are of steel or iron construction and vary from 238 to 366 feet in length, 40 to 64 feet in width, and 14 to 25 feet in molded depth. The capacities range from 12 to 30 railroad cars.

31. Vessels using the St. Lawrence Canals, the New York State Barge Canals, and the Richelieu River are especially designed for operation on these waterways. The typical vessel operating on the St. Lawrence Canals has a length of 250 feet, beam of 43 feet, moulded depth of 18 feet, and a capacity of 2,800 tons. This type of carrier transports the major portion of the freight (grain) from the lower end of the Great Lakes to Montreal.

32. Vessel traffic on the Richelieu River is confined almost wholly to barges. During the past few years, two of the paper companies exporting paper to the United States have constructed Diesel-powered barges especially designed for use on this waterway. The typical Diesel-powered barge is 113 feet long and 22 feet wide, with a capacity of 235 tons at a draft of 6·5 feet.

33. On the New York State barge canal system and Lake Champlain, the greater portion of the freight traffic at the present is in barges. The trend today is toward the construction and use of steel motor ships and steel barges. These motor ships are 250 to 300 feet long and 44 feet wide, with a molded depth of 15 feet and carrying capacities of 2,000 to 3,000 tons. Other vessels of similar design but powered by steam have a length of 290 feet, width of 43 feet, and a molded depth of 16 feet.

34. The major oil companies use motor ships for the distribution of petroleum and its products along the New York State barge canals, the lower

portion of the Great Lakes, and the upper St. Lawrence River. The largest of these self propelled tankers is 259 feet long and 38 feet wide, with a molded depth of 13 feet.

35. Table V, Appendix A, sets forth the number of ships and the gross registered tonnage of the vessels that comprised the fleet actually engaged in the commercial traffic on the Great Lakes in 1933. Such craft as tugs, lighters, and all other types recorded in official government lists which do not carry cargo, have been eliminated. Table VI shows the number and types of cargo-carrying vessels which operated on the New York State barge canal system during the season of 1935, including through vessels that operated on the Richelieu River, of both United States and Canadian registry. The 688 cargo vessels listed had an aggregate carrying capacity of 558,495 tons of freight.

36. Ocean-going vessels can operate on inland waters but the typical lake freighter cannot be operated on the open ocean because of its special design. The lake freighters are equipped with very little engine power compared with ocean vessels of equal capacity. They also have jet condensers and draw boiler feed water directly from the lake, hence cannot operate in salt water unless provided with new condenser systems. They are not sufficiently braced and do not have sufficient structural strength to withstand the storms on the open ocean. At least 70 per cent of all ocean-going freighters and combination passenger-freight vessels and approximately 30 per cent of all ocean-going tankers have salt water drafts less than 25 feet and would be suitable for operation on a fresh water route of 27-foot depth.

37. Terminal Facilities.—At the head of deep water on the Hudson River, the Albany Port District Commission owns and operates 5,400 feet of wharfage having an available depth of 27 feet and providing adequate berthage for 14 ocean vessels. Of the total wharfage, 4,200 feet are on the Albany side of the river and 1,200 feet on the Rensselaer side. A 13,500,000 bushel capacity grain elevator equipped with loading and unloading facilities for both water and rail transportation is operated by the same agency. Adjacent to the wharves are 6 storage sheds having a total of 280,000 square feet of floor space and a warehouse having 108,000 square feet of floor space. Also at Albany are the terminals of 9 of the larger oil companies of the United States.

38. The State of New York has provided terminal facilities on the Champlain division of the barge canal and private interests have provided similar facilities on Lake Champlain suitable for present barge canal traffic.

39. On the Richelieu River north of the international boundary there are wharves at Boyan, St. Paul, Ile aux Noix, Sabrevois, St. Johns, Iberville, Chambly, St. Mathias, Belœil, St. Hilaire, St. Charles, St. Marc, Larue, St. Denis, St. Antoine, St. Roch, St. Ours, and Ste. Victoire. These are mostly of timber construction with depths of water from 8 to 9 feet alongside. The main commodities handled over these wharves are coal, hay, and farm produce. The Canadian Industries Limited at their plant, 3 miles south of Belœil, have a concrete wharf 80 feet long, with a depth of 8 feet alongside.

40. At Sorel, at the junction of the Richelieu and St. Lawrence rivers, there are 4,070 feet of concrete wharves with a depth of 27 feet alongside and 3,000 feet of wharves with depths ranging from 10 feet to 20 feet. There is a modern grain elevator of 3,000,000 bushel capacity equipped with loading and unloading facilities for both water and rail transportation. There are several storage sheds having a total of 50,000 square feet of floor space.

41. Montreal Harbour, the head of deep draft navigation on the St. Lawrence River, 46 miles above Sorel, is a National Port administered and operated by the

National Harbours Board of Canada. It has a total of 10 miles of piers and wharves with depths alongside ranging from 20 to 35 feet; 4 grain elevators with a total capacity of 15,162,000 bushels; 20 two-story and 6 one-story transit sheds with a total of 2,100,000 square feet of floor space; and a modern ten-story cold storage warehouse with a capacity of 4,628,000 cubic feet. The Canadian Vickers Ltd. operate a self-docking floating dock of 25,000 tons capacity as well as a modern ship repair plant. There are numerous cargo handling derricks, cranes, and coal unloaders. Various oil companies have large plants for the receipt and distribution of petroleum products.

42. The important ports on the Great Lakes have terminal and transfer facilities which in most cases are adequate for the present commerce.

PRIOR REPORTS

43. Summaries of prior reports on a waterway to connect the Great Lakes-St. Lawrence System with the Hudson River are given in the following paragraphs.

44. PRIOR REPORTS BY UNITED STATES:—

Waterway	Year	Where Published	Remarks
Erie Canal route, Oswego-Mohawk route, and St. Lawrence-Richelieu-Champlain route.	1875	Annual Report of the Chief of Engineers 1875, Part 2, Page 534.	The estimated cost of enlarging the Erie Canal to pass boats of 690 tons was $8,173,596. The Oswego-Mohawk route was considered for a 10-foot depth, 140-foot width, in order to pass barges of 640 tons. Its estimated cost was $25,213,857. The proposed Champlain route was from Caughnawaga on the St. Lawrence, overland to St. Johns on the Richelieu River, thence to Lake Champlain, thence to Woods Creek, thence overland to the Hudson at Fort Edward, and down the Hudson to Albany. The canals on this route were to be 100 feet wide and 13 feet deep and pass steamers having a capacity of 1,500 tons. The estimated cost for the section from Lake Champlain to Albany was $14,115,893. It was assumed that the portion in Canada would be built and paid for by the Canadian Government.
Tonawanda-Olcott route, Oswego-Mohawk route, St. Lawrence-Richelieu-Champlain route, and Erie Canal route.	1897	H. Doc. No. 86, 55th Cong., 1st sess.	Unfavorable report discussed various ship canal routes but recommended that the construction of a ship canal was not desirable. Expressed the opinion that the construction of a barge canal 12 feet deep and 82 feet wide would serve to transport the tonnage from the Great Lakes to the sea and was worthy of being undertaken by the United States.
LaSalle-Lewiston route, Tonawanda-Olcott route, Oswego-Mohawk route, and Lake St. Francis-Lake Champlain route.	1900	H. Doc. No. 149, 56th Cong., 2nd sess.	Report of the Board of Engineers on Deep Waterways. This Board considered among others a route from Lake St. Francis overland to deep water in Lake Champlain, thence from Lake Champlain to deep water in the Hudson River. Two channel sizes were considered: one 21 feet deep with bottom widths of 215 feet in earth and 240 feet in rock, and the other 30 feet deep with bottom widths of 203 feet in earth and 250 feet in rock. Reported that the 21-foot channel by the LaSalle-Lewiston and Oswego-Mohawk route was the most desirable. The estimated cost was $206,358,000. For a 30-foot channel on the same route the estimated cost of $326,892,000, included the necessary deepening of the harbors of Duluth and Chicago.
Great Lakes-Hudson River.	1918	Sen. Doc. No. 301, 65th Cong., 2nd sess.	Unfavorable report of the Secretary of Commerce on the commercial advantage of a ship canal to connect the Great Lakes and the Hudson River.

44. PRIOR REPORTS BY UHITED STATES—*Concluded*

Waterway	Year	Where Published	Remarks
Waterway between the Great Lakes and the Hudson River.	1920	H. Doc. No. 890, 66th Cong., 3rd sess.	Preliminary examination for channel for ocean-going vessels. Chief of Engineers concurred in the views of the Board of Engineers for Rivers and Harbors and recommended no further consideration until completion and use of new Welland Canal and actual demonstration of the adequacy or inadequacy of the New York State Barge Canal.
Great Lakes to Hudson River. Three routes: Oswego to Hudson River; Buffalo to Hudson River; Lake Ontario, St. Lawrence River, Lake St. Francis and Lake Champlain to Hudson River.	1926	H. Doc. No. 288, 69th Cong., 1st sess.	Preliminary examination of waterway trom the Great Lakes to the Hudson River suitable for vessels of draft of 20 or 25 feet. Chief of Engineers concurred in the views of the Board of Engineers for Rivers and Harbors that the waterway should not be undertaken at that time. Recommended further study in connection with then pending report on St. Lawrence Waterway.
Great Lakes to Hudson River. Three routes: Oswego to Hudson River, Buffalo to Hudson River; Lake Ontario, St. Lawrence River, Lake St. Francis and Lake Champlain to Hudson River.	1926	H. Doc. No. 7, 69th Cong., 2nd sess.	Review of report contained in H. Doc. No. 288, 69th Cong., 1st sess. Chief of Engineers concurred in the recommendation of the Board of Engineers for Rivers and Harbors that the construction of a deep waterway between the Great Lakes and the Hudson River should not be undertaken at that time.

45. PRIOR REPORTS BY CANADIAN AUTHORITIES.—Upon completion of the Welland and St. Lawrence Canals to 9-foot depth in 1847, agitation arose for the construction of a canal of similar dimensions to connect the St. Lawrence River with Lake Champlain and thus provide a water route between Upper and Lower Canada and the United States Atlantic seaboard that would compete with the Erie Canal and the existing railways. As a result of this agitation, under instructions from the Commissioners of Public Works, five reports were made on various projects by Messrs. Mills (1848), Jarvis (1885), Gamble (1855), Swift (1855), and Gamble (1856).

46. The various projects considered can be briefly described as follows:—

(*a*) Enlargement of existing route up Richelieu River entailing deepening of river channels, construction of a new lock at St. Ours, and the enlargement of the Chambly Canal.

(*b*) Canal from Longueuil, opposite Montreal on the St. Lawrence River, to St. Johns on the Richelieu River. Total length of canal—28·5 miles. Rise in lockage from Longueuil to St. Johns—74 feet. Number of locks—6 lift and 1 guard.

(*c*) Champlain level canal from Caughnawaga, 10 miles above Montreal on the St. Lawrence River to St. Johns. Total length of Canal—32·5 miles. Rise in lockage from Caughnawaga to St. Johns—27 feet. Number of locks—2 lift and 1 guard.

(*d*) Summit level canal from Caughnawaga to St. Johns, with a summit level 33 feet above Lake Champlain level, supplied with water through a feeder canal, 16 miles long, from above the sixth lock on the Beauharnois Canal. Total length of canal—25·5 miles. Rise in lockage from Caughnawaga to summit—60 feet. Drop in lockage from summit to St. Johns—33 feet. Number of locks—8 lift and 1 guard.

(*e*) Same as (*d*) but with feeder canal from Beauharnois Canal made navigable to enable vessels to and from points on Lake St. Francis and above to proceed to Lake Champlain without descending to Lake St. Louis. The connection from Caughnawaga to St. Johns would be the same as in (*d*). The canal from the junction with the Beauharnois Canal to St. Johns would be as follows: Total length of canal—37·5 miles. Drop in lockage from Beauharnois Canal to St. Johns—34 feet. Number of locks—3 lift.

(*f*) Canal from a point 6 miles above the lower end of Lake St. Francis on the St. Lawrence River to a point 3·5 miles south of St. Johns on the Richelieu River. The country traversed by this canal was considered unfavourable to the construction of a canal. Total length of canal—56 miles. Drop in lockage from Lake St. Francis to the Richelieu River —57 feet.

With the exception of Jarvis, all the above Engineers recommended the adoption of Project (*c*), i.e. a canal from Caughnawaga to St. Johns. Jarvis favoured Project (*e*). The depth of canal proposed was 10 feet with locks 230 feet long and 45 feet wide.

47. Nothing further was done until 1870, when the "Caughnawaga Ship Canal Company" was incorporated with powers to build a canal from Lake St. Louis on the St. Lawrence River to Lake Champlain, and to use and enlarge the Chambly Canal with the consent of the Canadian Government. The company submitted plans which were approved by Order in Council but although the company's charter was extended from time to time, no work was ever done on the project.

48. In 1871, the "Canal Commission," referred to previously in this report, refrained from offering any recommendation in regard to the construction of a canal from the St. Lawrence River to Lake Champlain due to the fact that the Caughnawaga Ship Canal Company with a charter to construct such a canal was still in existence.

49. In 1895, at the request of the United States Government, Canada appointed three Commissioners to act with a similar number appointed by the United States to inquire and report on the feasibility of building a system of canals to open the Great Lakes to ocean-going vessels. The Canadian Commissioners, in their report of June 17, 1897, described a project for a canal between the lower end of Lake St. Francis and the Richelieu River at St. Johns. The length of this canal was 147 miles and two lift locks and one guard lock were proposed to overcome the difference in level of 57 feet. A branch canal 3·5 miles long with 3 locks with a combined lift of 84 feet was proposed to provide a connection between Lake St. Louis at Caughnawaga and the main canal. The depth proposed was 28 feet.

50. In 1898, the Lake Champlain and St. Lawrence Ship Canal Company was incorporated by Act of Parliament, with powers to develop hydraulic power and to construct a canal from the St. Lawrence River in the vicinity of Longueuil to some point on the Chambly Canal on the Richelieu River. Their charter was extended from time to time, the last extension being granted in 1911.

51. In 1906, the International Development Company, assignees of the Lake Champlain and St. Lawrence Ship Canal Company, applied to the International Waterways Commission for permission to construct regulating works in the Richelieu River. The Commission, in a joint report dated November 15, 1906, refused the application of the company and stated that the applicant should furnish conclusive evidence that private rights in the States of New York

and Vermont would not be affected by the alteration of the lake levels as proposed and that the works should not be undertaken without the permission of the United States Secretary of War and should be operated under such regulations as he might direct.

52. In 1911, the above-named company submitted plans for approval to the Dominion Government. According to these plans, the company proposed to construct a regulating dam across the river at Hospital Island about 5 miles north of the international boundary, with a lock at this point to pass navigation. Another dam was to be built at Fryers Island, from which point a canal 14 feet deep and 21·5 miles long left the river and crossed the country to the west to enter the St. Lawrence River at Longueuil below Victoria Bridge. Five locks were proposed to overcome the 74-foot difference in water level between the proposed regulated level of the Richelieu River at Fryers Island and the St. Lawrence River at Longueuil. A forebay was to be excavated from the navigation canal to a power house to be located on the shore of the Richelieu River below the upper dam of the Montreal Light, Heat and Power Company. The head available at this site was estimated to be about 26 feet and the minimum power available at 17,500 horse-power. No action was taken by the Government on these plans and the company's charter was allowed to lapse.

53. SUMMARY OF PRIOR REPORTS.—The various projects proposed and studied from time to time for a deep waterway from the St. Lawrence River to the Hudson River resolve into five probable routes for that portion of the waterway from the St. Lawrence River to Lake Champlain, as follows:

(*a*) From Lake St. Francis overland to Lake Champlain at the mouth of Big Chazy River, about 6 miles south of the international boundary.
(*b*) From Lake St. Francis overland to the Richelieu River above St. Johns, thence up the Richelieu River to Lake Champlain.
(*c*) From Caughnawaga on Lake St. Louis to the Richelieu River above St. Johns, thence up the Richelieu River to Lake Champlain.
(*d*) From Longueuil on the St. Lawrence River overland to the Richelieu River, thence up the Richelieu River to Lake Champlain.
(*e*) From Sorel on the St. Lawrence River up the Richelieu River to Lake Champlain.

All of the above routes are shown on the accompanying map, Plate No. 2, in Pocket.

HEARINGS OF INTERNATIONAL JOINT COMMISSION

54. From November 19 to 27, 1936, hearings were held by the International Joint Commission at New York City, Albany, Plattsburg, Burlington, and Montreal to receive testimony from interested parties in regard to the proposed improvement. The evidence presented at these hearings has been considered carefully in the preparation of this report.

ROUTES AND PLANS CONSIDERED

55. GENERAL.—Various routes for a canal from Montreal to Lake Champlain have been considered in the preparation of this report and are described in detail hereafter. Through Lake Champlain and from Lake Champlain to the Hudson River only one route is available. Since previous reports on routes between the St. Lawrence River and the Hudson River at Albany were made, various changes have taken place through the territory to be traversed. The country has become more densely populated and additional railway lines and new improved highways have been constructed, all of which would necessitate many more bridges than previously proposed.

56. In the plans considered the following standards were adopted for channel dimensions and bridge clearances:

A. CHANNELS

	Feet
12 foot Channel—	
Pool level depth in canal and river sections	12
Depth over lock sills	12
Channel widths—	
in earth cuts	75
in rock cuts	94
in river sections	200
in all cases widened about 15 per cent on curves.	
14 foot Channel—	
Pool level depth in canal and river sections	14
Depth over lock sills	12
Channel widths—	
in earth cuts	104
in rock cuts	120
in river sections	200
in all cases widened about 15 per cent on curves.	
27 foot Channel—	
Pool level depth in canal and river sections	27
Depth over lock sills	30
Channel widths—	
in earth cuts	200
in rock cuts	200
in river sections	450
in all cases widened about 15 per cent on curves.	

B. BRIDGES

12 foot Channel—	
Vertical Clearances—	
Existing fixed bridges	15½
New fixed bridges	20
Horizontal Clearances—	
Existing or new fixed bridges span entire channel in canal cuts.	
Existing or new fixed or movable in river sections.	150
14 foot Channel—	
Vertical Clearances—	
Existing fixed bridges raise to	20
New fixed bridges	20
Horizontal Clearances—	
Same as for 12 foot channel.	
27 foot Channel—	
Vertical Clearances—	
Fixed bridges and vertical lift bridges open	120
Horizontal Clearances—	
in canal cuts	200
in river sections, fixed bridges	300
Vertical lift and bascule bridges	300
Swing bridges, 2 openings, each	125

57. All estimates of cost included herein must be considered as approximate only, especially those of projects that contemplate an overland canal from the St. Lawrence River to the Richelieu River or to Lake Champlain. The only information available as regards the topography of these overland routes is that shown on the standard topographical maps published by the Canadian Government and in the report of the United States Deep Waterways Board in 1900. Limited information only is available in regard to the location of rock or the various kinds of overlying materials. A visual inspection of the various routes was made and with the use of the maps available approximate estimates have been prepared.

58. In considering the various projects described herein and in the estimates of costs submitted, the following assumptions have been made:

(*a*) That the 27-foot depth St. Lawrence Seaway is an accomplished fact and that it will have been completed prior to the construction of a waterway from Montreal through Lake Champlain to the Hudson River at Albany. This assumption is of importance only in consideration of a 27-foot depth waterway from Montreal to Albany.

(*b*) That the Canadian Government will proceed with the construction of the regulating dam in the Richelieu River at Fryers Island as presently proposed. The construction of this dam will include all channel enlargement, land and property damages, and all requisite works necessary to bring about the regulation of the water levels of, and the outflow from, Lake Champlain. The cost of the dam and connected works will not be a charge against the navigation projects considered herein. The rule adopted for regulation will be such that with a reasonable amount of channel enlargement over and above that required for regulation purposes, the maximum velocity in the river above the dam and below Chambly basin will not be too great for safe navigation.

(*c*) That the United States does no further work on existing projects along the route of the proposed waterway. The cost of all additional work required to provide the waterways considered within the United States, will be included in the cost estimates herein.

59. Waterway of 12-Foot Depth.—Due to the fact that a 12-foot depth is available in the Richelieu River from Sorel to above the St. Ours Lock and dredging is now underway to provide this same depth up to Chambly, the cheapest and most feasible route for a 12-foot waterway between Montreal and Lake Champlain is via Sorel and the Richelieu River. With some slight exception, a 12-foot depth is available in Lake Champlain from the international boundary to Whitehall, in the Champlain Division of the New York State barge canal, and in the Hudson River to Albany.

60. In Canada, the work required to provide a waterway of this depth, to the standards given hereinbefore, would be as follows:

(*a*) Widening, deepening, and straightening the river channel from above the St. Ours Lock to the head of the Chambly basin. Part of this work is under contract for completion at the present time.

(*b*) Construction of a canal with the necessary locks and other structures to carry navigation from Chambly basin to the river above the Fryers Island dam. Three lift locks would be required to overcome the difference in water level between Chambly basin and in the river above the dam. A guard lock would be required at the upper entrance to this canal to protect the reach above the upper lift lock.

(*c*) Widening, deepening, and straightening the river channel from the upper entrance of the canal at Fryers Island to the international boundary. Until it is known what channel enlargement is proposed between Fryers Island and St. Johns in connection with the regulating dam being built at the former point, it is impossible to say just what additional channel enlargement will be required in this reach to provide suitable velocities for navigation.

(*d*) Replacing certain of the existing bridges crossing the river in order to provide the requisite horizontal and vertical clearances for navigation.

The water required for lockage purposes with this project would amount to a maximum of 200 cubic feet per second which is only 20 per cent of the minimum natural flow of the Richelieu River.

61. In the United States, no additional work would be required except deepening and straightening the existing channel in Lake Champlain in the vicinity of Rouses Point. The water supply for lockage between Waterford and Lake Champlain is now made available from the Hudson River near Fort Edward, N.Y., and is ample.

62. The estimated capital cost and annual cost for construction of a 12-foot waterway from Montreal through Lake Champlain to the Hudson River are $12,884,000 and $953,000 respectively. Detailed estimates are given in Tables VII and IX, Appendix A.

63. WATERWAY OF 14-FOOT DEPTH.—The same route as proposed for the 12-foot waterway, i.e., via Sorel and the Richelieu River to Lake Champlain and via the Champlain Division of the New York State barge canal from Lake Champlain to the Hudson River, offers the cheapest and most feasible route for a 14-foot waterway between Montreal and the Hudson River.

64. In Canada, the work required to provide a waterway of this depth would be similar to that required for a 12-foot waterway with the addition that the depth of all channels would be increased 2 feet and all land cuts widened to conform to the standards given hereinbefore. The water required for lockage purposes with this project would be the same as that for the 12-foot waterway, viz., 200 cubic feet per second.

65. In the United States, the work required would be deepening between locks to 14 feet at normal pool levels, widening as necessary, and increasing the overhead clearance of bridges and other obstacles to 20 feet at maximum navigable stage. The water supply for lockage is ample.

66. The estimated capital cost and annual cost for construction of a 14-foot waterway from Montreal through Lake Champlain to the Hudson River are $50,006,000 and $2,738,600, respectively. Detailed estimates are given in Tables VIII and IX, Appendix A.

67. WATERWAY OF 27-FOOT DEPTH.—All routes on the Canadian side of the international boundary previously reported on for a waterway from the St. Lawrence River to Lake Champlain were considered in investigating projects for a waterway of 27-foot depth. Some of these were eliminated after casual examination and others were modified in order to conform to the standards of navigation adopted and on account of railways and highways located in the territory since these routes were first proposed.

68. Plate No. 3 in Pocket shows the various routes considered feasible. These are briefly described as follows:

Route A.—From Montreal up through Lake St. Louis into the Beauharnois Canal via the proposed St. Lawrence Deep Waterway, thence

overland to Lake Champlain at the mouth of the Big Chazy river about 6 miles south of the international boundary (from the Beauharnois Canal to Lake Champlain this project follows in general the route of the Lake St. Francis project reported on by the United States Deep Waterways Board in 1900.—House Doc. 149, 56th Congress, 2nd Session)—through Lake Champlain, the Narrows, the Champlain Division of the New York State barge canal, and thence down the upper Hudson river to the existing 27-foot depth at Albany.

Route B.—From Montreal up through Lake St. Louis into the Beauharnois Canal via the proposed St. Lawrence Deep Waterway, thence overland to a junction with the Richelieu river 3 miles south of St. Johns, thence up the Richelieu river to Lake Champlain, thence to Albany as described under Route A.

Route C.—From Montreal to Caughnawaga on Lake St. Louis via the proposed St. Lawrence Deep Waterway, thence overland to above the proposed Fryers Island dam to the Richelieu river, thence up the Richelieu river to Lake Champlain, thence to Albany as described under Route A.

Route D.—From Montreal to Longueuil on the south side of the St. Lawrence River opposite Montreal, thence overland to above the proposed Fryers Island dam in the Richelieu river, thence up the Richelieu river to Lake Champlain, thence to Albany as described under Route A.

Route E.—From Montreal down the St. Lawrence river to Sorel, thence up the Richelieu river to Lake Champlain, thence to Albany as described under Route A.

69. The estimated capital cost and annual cost of each of the routes described above, together with other data on which a comparison of the different routes can be made, are given in the following table in summarized form. Detailed estimates and other data are given in Tables X to XVI, Appendix A.

Item	Route				
	A	B	C	D	E
1. Capital cost in millions of dollars	443·1	361·3	344·0	360·6	342·2
2. Annual cost in millions of dollars	22·3	18·7	17·9	18·5	17·6
3. Number of locks, including guard locks, between—					
St. Lawrence River and New York	9	10	9	10	11
Duluth and New York	22	23	24	28	29
Montreal and New York	14	15	12	10	11
4. Miles of canal reaches between—					
St. Lawrence River and New York	67	65	52	47	35
Duluth and New York	117	117	109	115	103
Montreal and New York	85	81	63	47	35
5. Number of movable bridges between—					
St. Lawrence River and New York	48	58	56	45	44
Duluth and New York	74	84	84	77	76
Montreal and New York	54	64	60	45	44
6. Sailing time in days between—					
Duluth and New York	8·54	8·71	8·80	8·98	9·41
Montreal and New York	2·64	2·79	2·57	2·37	2·80

NOTE.—Items 3, 4, 5 and 6 include, where necessary, the various portions of the St. Lawrence Deep Waterway Project.

70. From the above table it is seen that the only advantages of Route "A", that is, the Lake St. Francis-Lake Champlain Route, are in the fewer number of locks to be passed through, and in its requiring the least sailing time between the Great Lakes and New York. These advantages are more than outweighed by the greater capital and annual cost of this route as compared with the other routes.

71. Routes B, C, and D, that is the Lake St. Francis-Richelieu River Route, the Lake St. Louis-Fryers Island Route, and the Longueuil-Fryers Island Route, have certain advantages as compared with Route E, the Sorel-Richelieu River Route, as regards sailing time. The estimated cost of Route C is not much greater than that of Route E. The canals on Routes B and C would cross all the main line railways and highways entering Montreal from the south. The necessary water supply for Route B would require the diversion of water from the St. Lawrence river to the Richelieu river watershed which would mean not only the loss of this water for future power development between Lake St. Francis and Montreal and some loss in channel depths in the St. Lawrence river between Montreal and Sorel but also would necessitate the provision on the Richelieu river for this increased flow during flood periods. The canal on Route D would cut off the cities of Longueuil and St. Lambert from direct access to the shore of the St. Lawrence river and would cross all main line railways and highways entering Montreal from the east. The entrance to such a canal from the St. Lawrence river would be far from satisfactory and while actual surveys might disclose a satisfactory location for a terminus somewhere between Longueuil and Sorel, this would not obviate the serious interruptions and delays to main line railway and highway traffic involved in the operation of such a canal.

72. Route E, the Sorel-Richelieu River Route, is considered the most practicable for a 27-foot waterway.

73. In Canada, the construction of a 27-foot depth canal on Route E would entail the deepening and straightening of the Richelieu river from its mouth at Sorel to St. Ours, where a new lock and dam would be built. From above St. Ours, the river would be deepened to Chambly where two locks in flight would be built to raise the water level about 71 feet to that of the water level above the proposed Fryers Island dam. From above the Chambly locks, a canal about 6 miles long would be dug to a junction with the Richelieu river above the proposed Fryers Island dam. A guard lock would be built near the head of this canal in order to protect the canal reach above the Chambly locks. From Fryers Island to Lake Champlain the river would require deepening and straightening to provide for deep water navigation.

74. From Sorel to the international boundary it is assumed that the number of bridges required to cross the navigation route can be limited to eight; that one double track railway bridge at St. Johns would replace the two existing single track bridges and that one combined highway and single track railway bridge would replace the two existing bridges at Noyan.

75. Water required for lockage purposes for a canal on Route E would be supplied from the flow of the Richelieu river. The maximum quantity of water required for any one day would be at the rate of 1,100 cubic feet per second. The average quantity of water required over any one month would be at the rate of 700 cubic feet per second. The natural minimum monthly outflow is 1,500 cubic feet per second. To the natural flow, however, would be added the water supplied for lockage purposes from the summit level down to Lake Champlain which would be supplied from the upper reaches of the Hudson river, as described hereafter.

76. In the United States, the construction of a 27-foot depth canal from the international boundary to Albany would entail the following work:—

(*a*) Widening, deepening, and straightening the existing channel in Lake Champlain from the international boundary to deep water opposite the mouth of the Big Chazy river about 6 miles south of the boundary.

(*b*) Widening, deepening, and straightening the channel in Lake Champlain from Port Henry to the head of the lake at Whitehall.

(*c*) Widening, deepening, and straightening the portion of the present Champlain Division of the New York State barge canal from Whitehall to Fort Edward. One lift lock would be required to overcome the difference in water level between Lake Champlain and the Hudson river at Fort Edward. A guard gate would be required at Fort Edward to prevent the water from the Hudson river flowing into Lake Champlain. The existing canal locks, 5 in number, would have to be removed.

(*d*) Widening, deepening, and straightening the existing channel in the Hudson river from Fort Edward to tide water at the United States lock and dam at Troy. Five lift locks would be required to overcome the difference in water level between Fort Edward and tide water at Troy. Four of the existing canal locks would have to be removed.

(*e*) Deepening the existing channel of the tidal Hudson river from the United States lock and dam at Troy to the head of the existing 27-foot channel at Albany.

(*f*) Replacing all of the existing fixed bridges crossing the waterway, and the railroad drawbridge crossing Lake Champlain at Rouses Point, in order to provide the requisite horizontal and vertical clearances for navigation.

77. The water required for lockage purposes would be supplied from the flow of the Hudson river at Fort Edward where the river forms a part of the summit level of the proposed waterway.

78. The estimated theoretical annual capacity of the 27-foot waterway is based on factors set out in a report on the St. Lawrence Deep Waterway Project prepared by an Interdepartmental Board appointed by the United States Government and published in 1934 in Senate Doc. No. 116, 73d Congress, 2d Session. These factors are as follows:

Days in season of navigation, average	230
Number of lockages per day, maximum	39
Lockage factor	0·62
Number of vessels per lockage, average	1·3
	Tons
Freight carried per vessel—tons of 2,000 pounds—average	3,800
Annual capacity of waterway from the above—in tons of 2,000 pounds—$230 \times 39 \times 0{\cdot}62 \times 1{\cdot}3 \times 3{,}800$	27,473,000
Assumed theoretical capacity	25,000,000

COMMERCIAL STATISTICS OF CONNECTING WATERWAYS

79. The New York State barge canal system connects the Hudson river with the Great Lakes and with Lake Champlain. The Richelieu river with its Chambly Canal section connects the lower St. Lawrence river with the Hudson river via Lake Champlain. The Welland Ship Canal with the St. Lawrence canal system form the connecting links between the Great Lakes and the Port of Montreal. Tables XVII to XXIII, inclusive, Appendix A, show the principal characteristics of the commerce moving through these connecting waterways.

80. Traffic statistics show that of the total movement of 5,866,182 tons through the St. Lawrence canals in 1935, there were included 209,244 tons of freight that moved westward from European and North American Atlantic ports to Great Lakes ports and 93,440 tons that moved eastward from the Great Lakes to European and Atlantic ports, without breaking bulk. During the past five or six seasons this through movement has accounted for considerable tonnage.

81. On the New York State barge canal system, there was an upward trend in the movement of traffic from 1840 through 1880. During the following ten-year periods to 1920, as shown in Table XVII, there was a steady decline which was arrested in 1929 and followed with a general upward movement during the six-year period 1930-1935. In 1935, the total movement was 4,489,172 tons. The same table also shows that the commerce passing through the Welland and St. Lawrence canals has followed a general upward course since 1900. In the record year of 1928, traffic through the St. Lawrence canals amounted to more than 8,400,000 tons. Traffic on the Chambly canal decreased steadily from 1910 to 1933, with a slight increase in each of the years 1934 and 1935, when the total reached 44,200 tons. This increase has been due mainly to increased shipments of paper from Canada to the United States which amounted to 11,200 tons in 1935.

82. The interstate and intrastate character of the total tonnage moved on the New York State barge canal system in 1935 is shown in Table XVIII. The ten principal commodities transported on the Barge Canal system in 1934 and their directional movement are shown in Table XIX. The development and directional flow of traffic during the ten-year period from 1926 to 1935, on the Erie and Oswego canals, and on the Champlain canal, are shown in Table XX. In 1935, the total tonnage on the Erie and Oswego canals amounted to 4,137,704 and on the Champlain canal 351,468. It is of interest to note the reversal in the preponderance of the movement which up to 1928 was eastward. The table shows that in 1928 about 52 per cent of the tonnage moved eastward and about 48 per cent westward. Thereafter, the bulk of the traffic moved westbound in increasing proportions until 1935 when 67 per cent of the total tonnage transported, moved westward. Increased tonnages of such commodities as petroleum and its products, sugar, and sulphur appear to be largely contributory to this change in directional flow.

83. Table XXI shows that in 1935 on the St. Lawrence canals, grain and soft coal, the latter received from United States ports, made up the bulk of the eastbound movement; gasoline, petroleum and other oils, pulpwood, anthracite coal, wood pulp, and sugar accounted for the major portion of the westbound tonnage. Through traffic eastbound amounted to about 2,700,000 tons and westbound 3,160,000 tons. Almost 575,000 tons of wood pulp and pulpwood moved to United States ports.

84. The directional flow of traffic on the Welland canal, 1935, is shown in Table XXII. The total movement amounted to about 8,960,000 tons of which 6,630,000 tons moved eastward and 2,330,000 tons westward. Wheat and bituminous coal accounted for 4,500,000 tons of the eastbound traffic, while westbound shipments of gasoline, petroleum and other oils, wood pulp, pulpwood, and general merchandise totalled 1,400,000 tons.

85. The direction flow of traffic on the Chambly canal during 1935 is shown in Table XXIII. The total movement amounted to 44,200 tons of which 35,900 tons moved southbound and 8,300 tons northbound. Of the total traffic 20,400 tons moved between Canadian ports and consisted of 12,800 tons of ore destined

from Sorel to Beloeil, and 7,600 tons of miscellaneous commodities. The movement from Canadian to United States ports amounted to 16,500 tons of which 11,200 tons were newsprint paper. The movement from United States to Canada amounted to 7,400 tons about equally divided between hard and soft coal and sand, gravel, and stone.

86. There is a large quantity of rail borne commerce moving between the areas affected by the proposed waterway. Statistics in regard to this movement are not available in such a form that they can be analysed to show the origin or destination of the commerce. Table XXIV, Appendix A, shows the estimated rail movement between Canada and the United States at all rail ports of entry between Megantic, Quebec, and Cornwall, Ontario, and also at the Niagara frontier rail ports, during the years 1929 to 1934. It is impossible to say what proportion of this moves during the navigation season or what proportion could be considered as potential to the suggested waterway. A large proportion of the imports to Canada is anthracite and bituminous coal.

POTENTIAL COMMERCE AND SAVINGS

87. Theoretically, all commerce moving during the navigation season between points on routes that could be served by the proposed Montreal to Hudson River waterway might be considered as "potential" commerce to either a 27, a 14, or a 12-foot waterway. Consideration of transfer costs between rail and vessel, vessel and rail, and between deep draft and shallow draft vessels tends to reduce the tonnage so derived as well as to differentiate between potential commerce for a 27-foot waterway and potential commerce for the shallower draft waterways.

88. The actual tonnage that would develop for a deep-draft waterway on Lake Champlain route is dependent not only on the extent of the use of the proposed St. Lawrence Waterway but also on the attractiveness of the Lake Champlain route as compared with the lower St. Lawrence and the Gulf.

89. Estimates of potential traffic in this report are based on commercial statistics for the years 1934 and 1935. These estimates are not intended to be definite predictions of prospective traffic at any future date after construction. The estimated total tonnages are the maximum available for the proposed waterway in the years considered and are therefore "potential" and not "prospective."

90. Due to the cost of transshipment and to the cheaper unit cost of transportation by deep draft vessel than by shallow canal draft vessel, it is believed that the 12-foot or 14-foot waterway will not attract traffic destined to or originating at St. Lawrence River ports from or to points that can be reached direct by deep draft vessels. For further discussion, see Appendix B.

91. The 27-foot waterway would generally influence the routing of commerce originating in the Great Lakes region and the St. Lawrence River valley in both the United States and Canada and destined to foreign ports or to Atlantic, Gulf, and Pacific ports of the United States and Canada and vice versa.

92. The St. Lawrence Seaway would provide a deep waterway from Lake Ontario to the Atlantic seaboard. Transportation costs via this route would be less than existing costs via rail or rail and water. Savings resulting from the use of this seaway would therefore be attributable to its improvement. With the

subsequent construction of a 27-foot waterway from Montreal to the Hudson river at Albany, two routes from the Great Lakes to the Atlantic would be available. In estimating potential savings for the 27-foot waterway connecting Montreal with the Hudson river at Albany, it is only necessary to compare distances, sailing times, and costs from Montreal through Lake Champlain and the Hudson river with similar data from Montreal through the Gulf of St. Lawrence. The following is an exception to the above statement. The combined St. Lawrence Deep Waterway and deep waterway from Montreal to the Hudson river at Albany might attract certain commerce, domestic to the United States, that would not be attracted by the St. Lawrence Deep Waterway alone. The unit saving on this commerce would be the difference between the present cost via the least expensive existing route, either rail or water, and the cost via the deep waterway from Montreal to the Hudson river. For such shipments, the savings estimated herein are greater than the savings that would actually result. For simplicity they are considered the same.

93. In all estimates of potential savings it has been assumed that all waterways considered will be toll free.

94. Tables XXV, XXVI, and XXVII, Appendix A, give actual and equivalent distances from Montreal to selected world ports via these two routes. An analysis shows that the Champlain route offers the shortest sailing time to the West Indies, Central America, Mexico, north and west coasts of South America, the Orient, Australia, and New Zealand, in addition to the United States Atlantic ports south of Portland, Maine, the United States Gulf ports, and the United States and Canadian Pacific ports. The time required for voyages from Montreal to the east and west coasts of Africa, the Philippines, India, France, Indo-China, and the east coast of South America would be approximately the same via either route and it is assumed that the commerce to and from those countries would be divided between the two routes.

95. In paragraphs 1 to 10 of Appendix B is a discussion of the unit transportation costs that would be effected by the construction of a 12-foot waterway and a 14-foot waterway. The results give savings per ton on all commerce that would use the waterway of approximately $0.35 for a 12-foot waterway and $0.45 for a 14-foot waterway.

96. Paragraphs 19 to 68 of Appendix B include a discussion of the total potential commerce for a 12 and 14-foot waterway. The total of this potential commerce is 168,000 tons. The estimated total annual potential savings for a 12-foot waterway is, therefore, $0.35 x 168,000=$58,800. The estimated total annual potential savings for a 14-foot waterway is $0.45 x 168,000=$75,600.

97. In paragraphs 11 to 18 of Appendix B is a discussion of the savings in unit transportation costs that would be effected by the construction of a 27-foot waterway. An analysis of the results obtained shows that the average saving per ton on all commerce that would use the waterway would be approximately $0.48.

98. In paragraphs 19 to 68 of Appendix B is a discussion of the potential Canadian commerce, including commerce between the United States and Canada, for the 27-foot waterway. The total estimated potential Canadian commerce for a 27-foot waterway is 706,000 tons per year.

99. In paragraphs 69 to 76 of Appendix B is a discussion of the potential foreign commerce of the United States, excluding commerce between the United States and Canada, for the proposed 27-foot waterway. The total of this potential commerce is 3,607,000 tons.

100. In paragraphs 77 to 103 of Appendix B is a discussion of the potential domestic commerce of the United States for the proposed 27-foot waterway. The total of this potential commerce is 5,500,000 tons.

101. The total potential commerce for a 27-foot waterway from Montreal through Lake Champlain to the Hudson River at Albany, totalling the figures in the above paragraphs, is 9,813,000 tons. The estimated total annual potential savings is, therefore, $0.48 x 9,813,000=$4,710,240.

Respectfully submitted,

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APPENDIX A

TABLE I.

DESCRIPTIVE DETAILS OF THE GREAT LAKES, INCLUDING LAKE ST. CLAIR

Lakes	Length	Width	Area of water surface	Total area of basin	Maximum recorded depth	Approved low water datum referred to mean sea level at New York City	Ordinary fluctuations of water surface	Average date of opening of navigation	Average date of closing of navigation
	Miles	Miles	Square miles	Square miles	Feet	Feet	Feet		
Superior	350	160	31,820	80,900	1,290	601·6	1·5	*April 19	*Dec. 17
Michigan	307	118	22,400	69,040	923	578·5	1·0	*April 12	**Dec. 15
Huron	206	101	23,010	72,420	750	578·5	2·4	*April 3	*Dec. 12
St. Clair	26	24	460	6,420	26	573·5	.....	*Mar. 21	*Dec. 17
Erie	241	57	9,940	34,680	210	570·5	3·5	*April 11	*Dec. 23
Ontario	193	53	7,540	34,630	774	244·0	4·5	*April 4	*Dec. 25

*At lower end of lake. **At upper end of lake.

TABLE II.

DESCRIPTIVE DETAILS OF CONNECTING RIVERS AND STRAITS OF THE GREAT LAKES

Rivers	Length	Least Width	Greatest Width	Limiting depth at low water	Current in navigated portions	Discharge at mean stage
	Miles	Feet	Feet	Feet	Miles per hour	Second feet
St. Marys	63	300	24,000	23·3	1—3½	(1)
Straits of Mackinac	30	10,900	100,000	27	.....	47,000
St. Clair	40	800	5,100	25	1—5	203,000
Detroit	31	1,900	19,000	21	1—6	208,000
Upper Niagara	20	1,500	8,000	10—23	1—7	207,000
Lower Niagara	15	210	2,600	30	1—2½	207,000
St. Lawrence (to Montreal)	179	1,200	40,000	14	1—6	240,000

(1) In its original condition, the mean stage discharge of the St. Marys River was about 78,000 cubic feet per second. The flow of this river is now entirely controlled by regulating works.

TABLE III.

DETAILS REGARDING EXISTING WATERWAYS

NEW YORK HARBOR TO LAKE CHAMPLAIN

—	Length (miles)	Number of Locks	Restricting Lock Dimensions	Total Lift	Minimum Channel Dimensions
Hudson River (New York Harbor (Battery, N.Y.C.) to Albany)	144				27′ deep; 300′ to 400′ wide.
Hudson River (Albany to Waterford)	11·5	1 lift	492·5′ long 44·44′ wide 14′ over sills	16·3	12′ deep; 90′ to 400′ wide.
New York State Barge Canal (Waterford to Whitehall)	60·4	11 lift	300′ long 45′ wide 12′ over sills	168·3	12′ deep; 75′ to 200′ wide.
Narrows of Lake Champlain (Whitehall to Benson Landing)	13·5				12′ deep; 110′ to 150′ wide.
Lake Champlain (Benson Landing to Boundary Line)	98·4				Over 30′ deep for 70 miles and 13′ to 30′ deep for 28·4 miles.

LAKE CHAMPLAIN TO MONTREAL

Richelieu River (Boundary Line to Chambly Canal)	23·0				7′ controlling depth.
Chambly Canal (St. Johns to Chambly)	11·8	8 lift 1 guard	120·5′ long 23·5′ wide 6·5′ over sills	71·5′	36′ wide.
Richelieu River (Chambly Canal to St. Ours Lock)	32·0				7′ controlling depth.
St. Ours Lock	0·12	1	339′ long 45′ wide 12′ over sills	5′	
Richelieu River (St. Ours Lock to Sorel)	14·0				12′ controlling depth.
St. Lawrence River (Sorel to Montreal)	46·0				30′ deep; 450′ to 750′ wide.

MONTREAL TO PORT COLBORNE ON LAKE ERIE

Lachine Canal (Montreal to Lachine)	8·7	4 lift 1 guard	270′ long 45′ wide 14′ over sills	46·2′	140′ wide.
Lake St. Louis and St. Lawrence River	16·0				13′ deep.
Soulanges Canal (Cascades Point to Coteau Landing)	14·7	4 lift 1 guard	280′ long 46′ wide 15′ over sills	83·5′	96′ wide.
St. Lawrence River and Lake St. Francis	31·0				14′ deep.
Cornwall Canal (Cornwall to Dickinsons Landing)	11·0	5 lift 1 guard	270′ long. 44′ wide 14′ over sills	48′	90′ wide.

TABLE III.—*Continued*

DETAILS REGARDING EXISTING WATERWAYS—*Continued*

MONTREAL TO PORT COLBORNE ON LAKE ERIE—*Concluded*

Section	Length (miles)	Number of Locks	Restricting Lock Dimensions	Total Lift	Minimum Channel Dimensions
St. Lawrence River	5·0				15′ deep.
Farrans Point Canal (Farrans Point Rapids)	1·3	1 lift	800′ long 50′ wide 16′ over sills	4·2′	80′ wide.
St. Lawrence River	9·5				15′ deep.
Rapide Plat Canal	3·9	1 lift 1 guard	270′ long 45′ wide 14′ over sills	11·6′	80′ wide.
St. Lawrence River	4·0				15′ deep.
Galops Canal (Rapids at Pointe aux Iroquois, Point Cardinal, and the Galops)	7·4	2 lift 1 guard	270′ long 45′ wide 14′ over sills	15·5′	80′ wide.
St. Lawrence River (Galops Canal to Chimney Point)	2·3				16′ deep; 300′ wide.
St. Lawrence River (Chimney Point to Lake Ontario)	66				27′ deep; 450′ wide.
Lake Ontario	160				Free navigation.
Welland Ship Canal (Port Weller on Lake Ontario to Port Colborne on Lake Erie)	27·6	4 single lift 3 twin lift in flight 1 guard	859′ long 80′ wide 30′ over miter sills	327′	25′ deep; 200′ wide.

OTTAWA RIVER—STE. ANNE ON ST. LAWRENCE RIVER TO OTTAWA, ONTARIO

Ste. Anne Lock (22 miles from Montreal via St. Lawrence River and Lachine Canal)	0·1	1	200′ long 45′ wide 9′ over sills	3′	9′ deep.
Lake of Two Mountains and Ottawa River	27·0				
Carillon Canal	1·0	2	200′ long 45′ wide 9′ over sills	14′	100′ wide; 9′ deep.
Ottawa River	6·2				
Grenville Canal	5·9	5	200′ long 45′ wide 9′6″ over sills	43′	45′ to 50′ wide; 9′ deep.
Ottawa River to Ottawa	56·0				

PORT COLBORNE TO FORT GRATIOT ON LAKE HURON

Lake Erie (Port Colborne to Detroit River)	218				Free navigation.
Detroit River	31				21′ to 25′ deep; 450′ to 800′ widths.

TABLE III.—*Concluded*

DETAILS REGARDING EXISTING WATERWAYS—*Concluded*

PORT COLBORNE TO FORT GRATIOT ON LAKE HURON—*Concluded*

Section	Length (miles)	Number of Locks	Restricting Lock Dimensions	Total Lift	Minimum Channel Dimensions
Lake St. Clair (Detroit River to outlet of south channel)	17	.....	.....	.....	23′ to 25′ deep; 500′ to 800′ widths.
South channel St. Clair flats	13	.....	.....	.....	25′ deep; 600′ to 1,000′ widths.
St. Clair River (Chenel Ecarte to Lake Huron)	27	.....	.....	.....	21′ deep—upbound; 25′ deep—downbound; 500′ to 1,000′ widths.
FORT GRATIOT ON LAKE HURON TO DULUTH ON LAKE SUPERIOR					
Lake Huron (Fort Gratiot to Pt. Detour)	223	.....	.....	.....	Free navigation.
St. Marys River (Point Detour to St. Marys Falls)	48	.....	.....	.....	20′ deep—upbound; 24′ deep—downbound; 300′ to 1,000′ widths.
St. Marys Falls Canal*	2	3 lift	1,350′ long 80′ wide 23·3′ over sills	19	282′ to 520′ wide.
Sault Ste. Marie Canal*	1·4	1 lift	900′ long 60′ wide 18·2′ over sills	19	142′ wide.
St. Marys River (St. Marys Falls Canal to head)	13	.....	.....	.....	26′ deep; 800′ to 1,500 wide.
Lake Superior (St. Marys River to Duluth)	383	.....	.....	.....	Free navigation.
FORT GRATIOT ON LAKE HURON TO CHICAGO ON LAKE MICHIGAN					
Lake Huron (Fort Gratiot to Straits of Mackinac)	247	.....	.....	.....	Free navigation.
Lake Michigan (Straits of Mackinac to Chicago)	321	.....	.....	.....	Free navigation.
WATERFORD TO OSWEGO AND BUFFALO, NEW YORK STATE BARGE CANAL SYSTEM					
**Waterford to Three Rivers Point	160·2	22 lift	328′ long 45′ wide 12′ over sills	461·8	12′ deep; 75′ to 200′ widths.
**Three Rivers Point to Oswego (Lake Ontario)	23·8	7 lift	328′ long 45′ wide 12′ over sills	118·6	12′ deep; 75′ to 200′ widths.
Three Rivers Point to Tonawanda	177·7	12 lift	328′ long 45′ wide 12′ over sills	198·7	12′ deep; 75′ to 200′ widths.
Tonawanda to Buffalo (Lake Erie)	14·4	1 lift	650′ long 68′ wide 21·7′ over sills	5·2	21′ deep; 200′ to 500′ widths.

* The 3 locks in the St. Marys Falls Canal (American) and the Sault Ste. Marie Lock (Canadian) are parallel.

** Now being improved through funds supplied by United States to depth of 14 feet and minimum width of 104 feet.

TABLE IV.

BRIDGES

HUDSON RIVER, NEW YORK CITY TO FORT EDWARD

Miles above the mouth	Name or Location	Type	Use	Vertical clearance of channel span above mean high water (feet)	Horizontal clearance of channel span (feet)	Plans approved by War Dept.
11	178th Street, New York City	Suspension	Highway	248 (center of span) 222 (pierhead line)	3,179 between pierhead lines	12/13/26
47·5	Bear Mountain	"	"	155	1,582	1/24/23
74	Mid-Hudson bridge at Poughkeepsie	"	"	137·6	1,458	5/29/24
75	N.Y., N.H. & H. R.R. at Poughkeepsie	Fixed	Railroad	167·7	490	8/17/06
112·5	Rip Van Winkle Catskill-Hudson Bridge	"	Highway	143·8	760	11/ 4/30
135·7	Hudson River connecting railroad south of Castleton	"	Railroad	138·9	550	5/ 2/17
144·6	Albany Rensselaer	Vertical lift	Highway	40 closed 139·5 raised	300	11/13/30
145·1	"	Swing	Railroad	27·7 closed	90 each side of pivot pier	3/7/1899
145·6	"	"	"	27·5 closed	"	4/ 8/01
149·7	Troy-Menands	Vertical lift	Highway	61·9 closed 139·4 raised	316	12/ 5/30
151·7	Troy-Watervliet, Congress-Street.	Swing	"	32 closed	180 each side of pivot pier	10/13/14
152·2	Troy-Green Island, Federal Street.	Vertical lift	Highway & Railroad.	24·4 closed 129·5 raised	167	8/10/22
154·7	Troy-Cohoes, 112th Street	Bascule	Highway	24·4* closed	200	3/24/21
156	Troy-Waterford	Fixed	"	14·3*	176	10/ 7/09
162·5	Lock No. 2, Mechanicville	"	"	16·8*	49·5	State
164·5	Mechanicville	"	"	15·5*	173	"
165·7	Mechanicville	"	Railroad	16·0*	89	3/21/13
167·3	Stillwater (canal)	"	Highway	16·8*	120	State
180·4	Schuylerville	"	"	17·2*	198	"
181·5	Schuylerville Lock No. 5.	"	"	15·5*	45·0	"
182·1	Northumberland	"	Railroad	15·5*	150·4	"
182·8	Northumberland	"	Highway	15·5*	200	No
185·3	Fort Miller (Canal below Lock No. 6)	Fixed	Highway	17·8*	45·0	No
185·7	Fort Miller (Canal)	"	"	16·1*	120·0	No
186·5	Fort Miller (Canal)	"	"	17·5*	120·0	No
187·3	Crocker's Reef	Vertical lift	Guard gate	16·5*	55·0	No

*From Troy-Cohoes to Crocker's Reef, vertical clearances listed are referred to maximum navigable stage.

TABLE IV.—*Continued*

BRIDGES—*Continued*

BARGE CANAL, FORT EDWARD TO WHITEHALL, N.Y.

Miles from Hudson River	Name or Location	Type	Use	Vertical clearance of channel span above normal pool level (feet)	Horizontal clearance of channel span (feet)	Plans approved by War Dept.
0·3	Fort Edward-Broadway..	Fixed	Highway	17·7	Full width of canal	.....
0·7	Fort Edward, Argyle St..	"	"	17·5	"	.....
1·3	Fort Edward, East St....	"	"	17·6	"	.....
3·9	Dunham's Basin.....	"	"	16·6	"	.....
6·5	George Henry's.....	"	"	17·0	"	.....
8·1	Smith's Basin.....	"	Railroad	19·0	"	.....
8·5	Smith's Basin.....	"	Highway	19·0	"	.....
10·8	Brayton's.....	"	"	18·4	"	.....
12·4	Fort Ann.....	"	"	19·0	"	.....
14·9	Dewey's.....	"	"	18·3	"	.....
16·4	Comstock.....	"	"	18·3	"	.....
17·5	Lock No. 11.....	"	"	19·0	"	.....
18·0	Comstock Prison Spur....	"	Railroad	19·1	"	.....
18·5	North of Lock No. 11....	"	Highway	18·9	"	.....
23·1	Whitehall.....	"	Railroad	17·7	"	.....
23·2	Whitehall, Boardman St..	"	Highway	22·5	"	.....
23·6	Whitehall, Saunders St...	Fixed	"	17·7	"	.....
23·7	Whitehall, foot bridge....	"	Foot	16·4	"	.....
23·8	Whitehall, Clinton Ave...	"	Highway	16·8	"	.....

LAKE CHAMPLAIN

Miles from head of lake	Name or Location	Type	Use	Vertical clearance of channel span above mean high water (feet) (1)	Horizontal clearance of channel span (feet)	Plans approved by War Dept.
35·5	Crown Point.....	Fixed	Highway	85·0	186	3/23/28
110·7	Rouses Point.....	Swing	Railroad	7·0	89·3 each side of pivot pier	2/10/1899
111·1	Rouses Point (2).....	"	Highway	17·5	125·0 each side of pivot pier	8/23/35

(1) Refers to plane 5 feet above low lake level—elevation 92·5 feet above M.S.L.
(2) Under construction.

TABLE IV.—*Concluded*

BRIDGES—*Concluded*

RICHELIEU RIVER (DOMINION OF CANADA)

Miles from Border	Name or Location	Type	Use	Vertical clearance of channel span above normal pool level (feet)	Horizontal clearance of channel span (feet)	Plans approved by War Dept.
3·6	Noyan	Swing	Railroad	9·75	97·0	.....
3·9	Noyan	"	Highway	8·45	East span 79·6	.....
					West span 82·6	.....
21·6	St. Johns	"	Railroad	7·2	47·3	.....
21·9	St. Johns (Pont Gouin)	Lift	Highway	8·9	76·3	.....
21·9	Same bridge, Iberville span	"	"	8·9	39·5	.....
22·1	St. Johns (Canal span)	Swing	Railroad	11·7	31·0	.....
25·0	Chambly Canal No. 1 below St. Johns	"	Highway	3·5	35·3	.....
27·6	Chambly Canal No. 2 below St. Johns	"	"	2·0	28·0	.....
28·4	Chambly Canal at Fryers Island, No. 3 below St. Johns	"	"	2·0	27·0	.....
29·6	Chambly Canal, No. 4 below St. Johns	"	"	2·5	26·6	.....
30·1	Chambly Canal, No. 5 below St. Johns	"	"	2·0	30·5	.....
30·6	Chambly Canal, No. 6 below St. Johns	"	"	3·1	25·0	.....
31·3	Chambly Canal, No. 7 below St. Johns	"	"	2·6	25·0	.....
31·9	Chambly Canal, No. 8 below St. Johns	"	Railroad	3·9	33·2	.....
32·8	Chambly Canal, No. 9 below St. Johns	Swing	Highway	2·6	30·0	.....
33·2	Chambly Canal, Montreal-Sherbrooke Highway	"	"	2·0	23·7	.....
41·1	Beloeil	Swing	Railroad	27·2	46·0	.....
77·5	Sorel	"	"	27·4	97·0	.....
77·9	Sorel	Double lift	Highway	49·4	164·5	.....

TABLE V.

VESSELS ON THE GREAT LAKES BY TYPES AND TRADES, 1933

Types of vessels* and principal trade	United States registry		Canadian registry		Total	
	Number	Gross Tonnage	Number	Gross Tonnage	Number	Gross Tonnage
STEAMERS						
Bulk freighters—						
Ore, coal and grain	326	1,874,463	46	230,664	372	2,105,127
Stone and coal, self-unloading	28	149,552	.....	.....	28	149,552
Cement and coal, self-unloading	4	11,510	.....	.....	4	11,510
Sand and gravel	20	40,173	6	8,131	26	48,304
Grain, coal and pulp, lower lakes fleet	.....	.....	165	297,520	165	297,520
Coal, self-unloading	.....	.....	6	17,285	6	17,285
Grain, self-unloading	.....	.....	1	2,037	1	2,037
Cement, self-unloading	.....	.....	1	2,376	1	2,376
Not in commission	.....	.....	3	6,357	3	6,357
Total bulk freighters	378	2,075,698	228	564,370	606	2,640,068
Package—						
Package, freight, hard coal and grain	26	93,082	.....	.....	26	93,082
Package freight and grain	.....	.....	2	5,977	2	5,977
Package freight and grain, lower lakes	.....	.....	20	41,090	20	41,090
Total package freighters	26	93,082	22	47,067	48	140,149

TABLE V.—*Concluded*

VESSELS ON THE GREAT LAKES BY TYPES AND TRADES, 1933—*Concluded*

Types of vessels* and principal trade	United States registry		Canadian registry		Total	
	Number	Gross Tonnage	Number	Gross Tonnage	Number	Gross Tonnage
Passenger—						
Passenger ships	31	93,593	9	32,337	40	125,930
Passenger ships, lower lakes			6	13,154	6	13,154
Total passenger ships	31	93,593	15	45,491	46	139,084
MOTORSHIPS						
Bulk freighters—						
Ore and coal	2	17,503			2	17,503
Sand	2	3,140			2	3,140
Cement			1	1,970	1	1,970
Total motorships	4	20,643	1	1,970	5	22,613
BARGES						
Ore, coal, grain	8	22,856			8	22,856
Ore	14	49,778			14	49,778
Coal, coke, lumber, sand and gravel	11	28,629			11	28,629
Coal and grain			8	18,023	8	18,023
Coal, lumber, scrap, sand and pulp (wood)	10	12,263			10	12,263
Coal, Lake Ontario and St. Lawrence (wood)			13	11,932	13	11,932
Oil	1	3,200	1	960	2	4,160
Total barges	44	116,726	22	30,915	66	147,641
MISCELLANEOUS						
Automobile carriers, steamers	11	38,602			11	38,602
Oil tankers, steamers, and motorships	12	31,992	19	35,754	31	67,746
Steel, grain, and special trades, canal-lake type motorships	16	20,849			16	20,849
Auto parts and special trades, New York barge canal-lake type steamers	2	3,638			2	3,638
Grain, coal, paper, and package freight, motorships			5	10,407	5	10,407
Car ferries	31	82,979	3	11,766	34	94,745
Coal, grain, steel, scrap, package freight, and salt, Shipping Board type steamers	18	41,426			18	41,426
Coal trade, iron steamers	1	1,618			1	1,618
Coal and grain, composite steamers			4	5,135	4	5,135
Coal, scrap, salt, and lumber (wood)	9	7,373			9	7,373
Coal and sand (wood or iron steamers)			4	4,629	4	4,629
Passenger and freight steamers	7	7,383			7	7,383
Total miscellaneous	107	235,860	35	67,691	142	303,551
Grand total	590	2,635,602	323	757,504	913	3,393,106

SOURCE: Annual Report, Lake Carriers' Association.

*Constructed of steel unless otherwise stated.

TABLE VI.

VESSELS OPERATING ON THE NEW YORK BARGE CANAL SYSTEM, 1935, INCLUDING THROUGH VESSELS FOR THE RICHELIEU RIVER OF BOTH UNITED STATES AND CANADIAN REGISTRY

Type and number	Carrying capacity per unit in net tons	Type and number	Carrying capacity per unit in net tons
Motorships, tankers (1)—		Barges, other (2)—	
1	700	2	150
8	1,100	24	300
2	1,200	2	400
2	1,500	27 steel	450
9	2,000	32	500
1	2,500	184	600
3	2,600	7	650
Total, 26.		44	700
		6	750
Motorships, other (1)—		60	800
		37	900
1	185	38 one steel	1,000
1	225	17	1,200
1 wood	300	1	1,500
3	500	Total, 481.	
1	1,000		
1	1,300	Total Barges, 555.	
1	1,400		
1	1,500		
5	1,800	Miscellaneous (2)—	
2	2,175		
2	2,600	Scows 78 two steel	
1	2,800	Fishboat 1	100
1	3,000	Steamers 3	185
Total, 21.		Lighters 4	500
Total motorships, 47.		Total, 86.	
		Grand total, 688.	
Barges, tank (1)—			
1	500		
3	600		
11	750		
5	900		
5	1,000		
4	1,100		
1	1,200		
22	1,500		
12	1,800		
8	2,000		
2	2,400		
Total, 74.			

SOURCE: Annual Report, Superintendent, Department of Public Works, State of New York.

(1) Constructed of steel unless otherwise stated.

(2) Constructed of wood unless otherwise stated.

TABLE VII

ESTIMATE OF FIRST COST OF 12-FOOT WATERWAY

From Montreal down the St. Lawrence River to Sorel, thence up the Richelieu River to Lake Champlain, thence via Lake Champlain, the Champlain Division of the New York State Barge Canal and the Hudson River to deep water at Albany, N.Y.

1. Sorel to International Boundary

Based on assumption that Canadian Government completes regulating dam in Richelieu River, including channel enlargement, land and property damages and all requisite works necessary in connection with regulation of water levels of and outflow from Lake Champlain.

Item	Quantity	Unit	Unit price	Amount	Total
			$ cts.	$	$
Excavation—					
Earth, dry	2,591,360	cu. yd.	0 50	1,295,680	
Earth, wet	4,350,500	"	0 40	1,740,200	
Rock, dry	4,220	"	2 00	8,440	
Rock, wet	21,400	"	5 00	107,000	
Bridges	7	No.	.....	4,700,000	
Embankments	291,100	cu. yd.	0 35	101,880	
Guard lock	1	No.	.....	300,000	
Lift locks	3	"	.....	1,300,000	
Walls (concrete)	60,200	cu. yd.	10 00	602,000	
Highway changes	3·5	mile	20,000 00	70,000	
Right-of-way	.....	.....	.....	300,000	
Canal lighting and buildings	.....	.....	.....	55,000	
Paving slopes—canal prism—concrete	10,930	cu. yd.	10 00	109,300	
Total cost of construction					10,689,500
Inspections, surveys, superintendence, and contingencies					1,336,500
Total for work in Canada					$12,026,000

2. International Boundary to Albany—

Item	Quantity	Unit	Unit Price	Amount	Total
			$ cts.	$	$
Excavation—					
Earth, wet	100,000	cu. yd.	1 00	100,000	
Total cost of construction					100,000
Inspection, surveys, superintendence, and contingencies					15,000
Total for work in United States					115,000
Grand Total 12-foot Waterway					$ 12,141,000

TABLE VIII

ESTIMATE OF FIRST COST OF 14-FOOT WATERWAY

From Montreal down the St. Lawrence River to Sorel, thence up the Richelieu River to Lake Champlain, thence via Lake Champlain, the Champlain Division of the New York State Barge Canal and the Hudson River to deep water at Albany, N.Y.

1. Sorel to International Boundary

Based on assumption that Canadian Government completes Regulating Dam in Richelieu River, including channel enlargement, land and property damages and all requisite works necessary in connection with regulation of water levels of and outflow from Lake Champlain.

Item	Quantity	Unit	Unit Price	Amount	Total
			$ cts.	$	$
Excavation—					
Earth, dry	3,299,700	cu. yd.	0 50	1,649,850	
Earth, wet	7,208,900	"	0 40	2,883,560	
Rock, dry	8,740	"	2 00	17,480	
Rock, wet	77,600	"	5 00	388,000	
Bridges	7	No.	.....	4,800,000	
Embankments	291,100	cu. yd.	0 35	101,880	
Guard locks	1	No.	.....	300,000	
Lift locks	3	"	.....	1,300,000	
Walls (concrete)	60,200	cu. yd.	10 00	602,000	
Highway changes	3·5	mile	20,000 00	70,000	
Right-of-way	.....	.....	.....	300,000	
Canal lighting and buildings	.....	.....	.....	55,000	
Paving slopes—canal prism—concrete	10,930	cu. yd.	10 00	109,300	
Total cost of construction					12,577,070
Inspection, surveys, superintendence, and contingencies					1,572,930
Total for work in Canada					$14,150,000

2. International Boundary to Albany—

Based on assumption that the existing channel in the Hudson River from the Lock and Dam at Troy to deep water at Albany will be deepened to a depth of 14 feet with two-foot allowable overdepth at mean low water for its full width.

Item	Quantity	Unit	Unit Price	Amount	Total
			$ cts.	$	$
Excavation—					
Earth, wet	600,000	cu. yd.	0 30	180,000	
Earth, wet	3,900,000	"	0 50	1,950,000	
Earth, wet	3,720,000	"	1 00	3,720,000	
Earth, wet	20,000	"	1 30	26,000	
Rock, wet	2,599,000	"	7 00	18,193,000	
Rock, wet	230,000	"	10 00	2,300,000	
Raising bridges (31)	.....	.....	.....	2,500,000	
Bank protection	.....	.....	.....	500,000	
Total cost of construction					29,369,000
Inspection, surveys, superintendence, and contingencies					3,631,000
Total for work in United States					33,000,000
Grand Total for 14-foot Waterway					$47,150,000

TABLE IX

ESTIMATED CAPITAL AND ANNUAL COST FOR A 12-FOOT AND A 14-FOOT WATERWAY BETWEEN MONTREAL AND THE HUDSON RIVER AT ALBANY, NEW YORK

Item	Estimate for 12-foot Waterway	Estimate for 14-foot Waterway
Capital Cost—	$	$
Construction	12,141,000	47,150,000
Aids to Navigation (additional)	14,000	25,000
Interest during construction (period =3 yrs., interest at 4%=6%)	729,000	2,831,000
Total Capital Cost	12,884,000	50,006,000
Annual Cost—		
Interest on capital=4%	515,400	2,000,300
Amortization (at 4%)—		
Fixed structures, 50 years=0·655%	63,400	286,300
Movable structures, 25 years=2·40%	77,200	151,000
Maintenance and operation of movable bridges at $10,000	70,000	70,000
Maintenance of fixed bridges at $3,000	93,000	93,000
Maintenance and operation of locks at $25,000	425,000	425,000
Maintenance of canal reaches at $3,000 per mile	126,000	126,000
Maintenance of Aids to Navigation	6,000	10,000
Total Annual Cost	1,376,000	3,161,600
Deduct annual maintenance and operating cost of existing waterway	423,000	423,000
Net increase in Annual Cost	953,000	2,738,600

TABLE X

ESTIMATE OF FIRST COST OF 27-FOOT WATERWAY

Route A.—From Montreal up through Lake St. Louis into the Beauharnois Canal via the proposed St. Lawrence Deep Waterway, thence overland to Lake Champlain at the mouth of the Big Chazy River, thence via Lake Champlain, the Lake Champlain Division of the New York State Barge Canal, and the Hudson River to the head of the 27-foot channel at Albany, N.Y.

1. Beauharnois Canal to the International Boundary

Item	Quantity	Unit	Unit Price	Amount	Total
Excavation—			$ cts.	$	$
Earth, dry	26,500,000	cu. yd.	0 50	13,250,000	
Rock, dry	50,249,000	"	2 00	100,498,000	
Enbankment, excavation—					
Necessary furnished from canal prism	9,134,000	"	0 25	2,283,500	
Chateaugay River, required excavation not computed separately	1,344,000	"	0 30	403,200	
Retaining wall	237,400	"	10 00	2,374,000	
Slope wall	401,600	sq. yd.	1 50	602,400	
Backfill	715,000	cu. yd.	0 30	214,500	
Approach walls for locks	64,000	"	10 00	640,000	
Right-of-way—					
Village property	14½	acres	3,000 00	43,500	
Farm land	4,750	"	150 00	712,500	
Farm land	1,170	"	200 00	234,000	
Railroad changes	14·07	miles	50,000 00	703,500	
Gates (sluice and by-pass)	Lump sum	.....	.....	40,000	
Bridges—					
Highway	6	No.	400,000 00	2,400,000	
Railroad	2	"	500,000 00	1,000,000	
Guard lock (concrete)	160,000	cu. yd.	15 00	2,400,000	
Lock gates and operating machinery	Lump sum	.....	.....	632,600	
Valves and operating machinery	"	.....	.....	100,000	
Fenders, capstans, lighting equipment	"	.....	.....	206,700	
Dam (concrete)	17,685	cu. yd.	15 00	265,275	
Gate (dam)	Lump sum	.....	.....	5,000	
Stream entrances and crossing	"	.....	.....	2,500,000	
Total cost of construction					131,508,675
Inspection, surveys, superintendence, and contingencies					16,431,325
Total for work in Canada					147,940,000

TABLE X—*Continued*

2. International Boundary to Lake Champlain

Item	Quantity	Unit	Unit Price	Amount	Total
			$ cts.	$	$
Excavation—					
Earth, dry	2,800,000	cu. yd.	0 50	1,400,000	
Earth, wet	7,400,000	"	0 60	4,440,000	
Earth, wet	4,500,000	"	0 20	900,000	
Rock, dry	751,000	"	2 00	1,502,000	
Rock, wet	4,300,000	"	4 00	17,200,000	
Retaining wall	200,000	"	10 00	2,000,000	
Slope wall	100,000	sq. yd.	1 50	150,000	
Backfill	600,000	cu. yd.	0 30	180,000	
Approach walls for lock	64,000	"	10 00	640,000	
Village property	13	acres	3,000 00	39,000	
Farm land	700	"	150 00	105,000	
Farm land	260	"	200 00	52,000	
Bridges—					
Highway	4	No.	400,000 00	1,600,000	
Railroad	2	"	500,000 00	1,000,000	
Lift lock (concrete)	297,500	cu. yd.	15 00	4,462,500	
Gates and operating machinery	Lump sum	.....	.....	897,400	
Valves and operating machinery	"	.....	.....	100,000	
Fenders, capstans, lighting equipment, etc	"	.....	.....	206,700	
Dam (concrete)	1,315	cu. yd.	15 00	19,725	
Champlain Waterworks changes	Lump sum	.....	.....	150,000	
Stream entrances and crossings	"	.....	.....	500,000	
					37,544,325

3. Lake Champlain to Whitehall

Excavation—					
Earth, wet	62,400,000	cu. yd.	0 20	12,480,000	
Rock, quartzite, dry	450,000	"	1 60	720,000	
Rock, quartzite, wet	130,000	"	5 00	650,000	
Rock, shale, wet	100,000	"	4 00	400,000	
Right-of-way—					
Village property	120	acres	3,000 00	360,000	
Farm property	192	"	100 00	19,200	
Railroad changes	Lump sum	.....	.....	80,000	
Bridge	1	bridge	.....	2,000,000	
					16,709,200

4. Whitehall to Fort Edward

Excavation—					
Earth, wet	64,300,000	cu. yd.	0 20	12,860,000	
Rock, wet, quartzite	2,380,000	"	5 00	11,900,000	
Rock, wet, shale	1,180,000	"	4 00	4,720,000	
Retaining walls (concrete)	93,900	"	10 00	939,000	
Slope walls	506,000	sq. yd.	1 50	759,000	
Backfill	354,000	cu. yd.	0 30	106,200	
Approach walls	128,000	"	10 00	1,280,000	
Right-of-way—					
Village property	477	acres	3,000 00	1,431,000	
Farm property	5,594	"	200 00	1,118,800	
Railroad changes	Lump sum	.....	.....	80,000	
Bridges—					
Highway	13	No.	400,000 00	5,200,000	
Railroad	2	"	500,000 00	1,000,000	
Entrance of streams	Lump sum	.....	.....	60,000	
Gates for by-pass	"	.....	.....	60,000	
Lock and guard lock (concrete)	374,000	cu. yd.	15 00	5,610,000	
Lock gates and operating machinery	Lump sum	.....	.....	1,371,700	
Valves and operating machinery	"	.....	.....	200,000	
Fenders, capstans, lighting equipment	"	.....	.....	413,400	
Remove barge canal locks	5	No.	200,000 00	1,000,000	
Maintenance of barge canal during construction	Lump sum	.....	.....	500,000	
					50,609,100

TABLE X—*Concluded*

5. Fort Edward to Troy

Item	Quantity	Unit	Unit Price	Amount	Total
			$ cts.	$	$
Excavation—					
Earth, dry	16,600,000	cu. yd.	0 50	8,300,000	
Earth, wet	30,390,000	"	0 20	6,078,000	
Rock, dry	3,720,000	"	1 60	5,952,000	
Rock, wet	12,980,000	"	4 00	51,920 000	
Retaining wall (concrete)	159,600	"	10 00	1,596,000	
Slope walls	380,000	sq. yd.	1 50	570,000	
Backfill	660,000	cu. yd.	0 30	198,000	
Approach walls	367,400	"	10 00	3,674,000	
Bridges—					
Highway	10	No.	400,000 00	4,000,000	
Railroad	1	"	500,000 00	500,000	
Dams, alterations	4	"	250,000 00	1,000,000	
Right-of-way	Lump sum	.....	.....	4,000,000	
Locks (5) concrete	1,047,500	cu. yd.	15 00	15,712,500	
Gates and operating machinery	Lump sum	.....	.....	3,655,000	
Valves and operating machinery	"	.....	.....	500,000	
Fenders, capstans, lighting equipment	"	.....	.....	1,033,500	
Remove barge canal locks	4	No.	200,000 00	800,000	
Maintenance of barge canal during construction	Lump sum	.....	.....	500,000	
					109,989,000

6. Troy to Albany

Excavation—					
Earth, wet (hydraulic)	3,000,000	cu. yd.	0 20	600,000	
Earth, wet (rehandle)	4,500,000	"	0 60	2,700,000	
Rock, wet (rehandle)	3,000,000	"	5 00	15,000,000	
					18,300,000
Total cost of construction					233,151,625
Inspection, surveys, superintendence, and contingencies					29,151,375
Total for Work in the United States					262,303,000
Grand Total—Route A					410,243,000

TABLE XI

ESTIMATE OF FIRST COST OF 27-FOOT WATERWAY

Route B.—From Montreal up through Lake Saint Louis into the Beauharnois Canal via the propose St. Lawrence Deep Waterway, thence overland to above the proposed Fryers Island dam in the Richelieu River, thence up the Richelieu River to Lake Champlain, thence via Lake Champlain, the Champlain division of the New York State Barge Canal, and the Hudson River to the head of the 27 foot channel at Albany, N.Y.

1. Lake St. Francis to Richelieu River, 3 miles south of St. Johns

Item	Quantity	Unit	Unit Price	Amount	Total
			$ cts.	$	$
Excavation—					
Earth, dry	20,100,000	cu. yd.	0 40	8,040,000	
Rock, dry	19,085,000	"	2 00	38,170,000	
Embankment	21,570,000	"	0 35	7,549,500	
Lift locks	2	No.	.....	10,000,000	
Guard lock	1	"	.....	3,500,000	
Guard gate	1	"	.....	850,000	
Bridges	21	"	.....	9,000,000	
Right-of-way	4,700	acres	250 00	1,175,000	
River entrances and crossings	.....	.....	.....	5,400,000	
Paving slopes, canal prism, concrete	194,000	cu. yd.	10 00	1,940,000	
					85,624,500

2. Three Miles South of St. Johns to International Boundary (Richelieu River)

Excavation—					
Earth, wet	24,500,000	cu. yd.	0 40	9,800,000	
Bridges	1	No.	.....	1,500,000	
					11,300,000
Total cost of construction					96,924,500
Inspection, surveys, superintendence and contingencies					12,075,500
Total for Work in Canada					109,000,000

1. International Boundary to deep water in Lake Champlain

Item	Quantity	Unit	Unit Price	Amount	Total
			$ cts.	$	$
Excavation	5,500,000	cu. yd.	0 50	2,750,000	
Bridges	1	No.	.....	2,000,000	
					4,750,000

2. Deep water Lake Champlain to Albany, N.Y. (From Table X)..... 195,607,300

Total cost of construction	200,357,300
Inspection, surveys, superintendence and contingencies	25,084,700
Total for Work in the United States	225,442,000
Grand Total for Route B	334,442,000

TABLE XII

ESTIMATE OF FIRST COST OF 27-FOOT WATERWAY

Route C.—From Montreal to Caughnawaga on Lake St. Louis via the proposed St. Lawrence Deep Waterway, thence overland to above the proposed Fryers Island dam in the Richelieu River, thence up the Richelieu River to Lake Champlain, thence via Lake Champlain, the Lake Champlain division of the New York State Barge Canal, and the Hudson River to the head of the 27 foot channel at Albany, N.Y.

1. Lake St. Louis to Fryers Island on the Richelieu River

Item	Quantity	Unit	Unit Price	Amount	Total
			$ cts.	$	
Excavation—					
Earth, dry	33,240,000	cy. yd.	0 50	16,620,000	
Rock, dry	5,160,000	"	2 00	10,320,000	
Rock, wet	2,200,000	"	5 00	11,000,000	
Embankment	10,607,000	"	0 35	3,712,450	
Lift lock	1	No.	.....	5,000,000	
Guard lock	1	"	.....	3,500,000	
Guard gate	1	"	.....	850,000	
Bridges	17	"	.....	7,800,000	
Right-of-way	3,000	acres	250 00	750,000	
Highway changes	5	miles	20,000 00	100,000	
River entrances and crossings	.....	.....	.....	3,200,000	
Paving slopes, canal prism, concrete	130,000	cu. yd.	10 00	1,300,000	
					64,152,450

2. Fryers Island to International Boundary (Richelieu River)

Excavation	36,472,000	cu. yd.	0 40	14,588,800	
Bridges	3	No.	.....	4,000,000	
Right-of-way	100	acres	200 00	20,000	
					18,608,800
Total cost of construction					82,761,250
Inspection, surveys, superintendence and contingencies					10,304,750
Total for work in Canada					93,066,000
3. International Boundary to Albany (From Table XI)					200,357,300
Total cost of construction					200,357,300
Inspection, surveys, superintendence and contingencies					25,084,700
Total for work in United States					225,442,000
Grand total for route C					318,508,000

TABLE XIII

ESTIMATE OF FIRST COST OF 27-FOOT WATERWAY

Route D.—From Montreal to Longueuil on the south side of the St. Lawrence River opposite Montreal, thence overland to above the proposed Fryers Island dam in the Richelieu River, thence up the Richelieu River to Lake Champlain, thence via Lake Champlain, the Champlain division of the New York State Barge Canal, and the Hudson River to the head of the 27 foot channel at Albany, N.Y.

1. Longueuil to Fryers Island on the Richelieu River

Item	Quantity	Unit	Unit Price	Amount	Total
			$ cts.	$	$
Excavation—					
Earth, dry	21,500,000	cu. yd.	0 50	10,750,000	
Earth, wet	250,000	"	0 40	100,000	
Rock, dry	15,800,000	"	2 00	31,600,000	
Rock, wet	1,485,000	"	5 00	7,425,000	
Embankment	3,170,000	"	.....	1,109,500	
Lift locks	2	No.	.....	10,000,000	
Guard lock	1	"	.....	3,500,000	
Bridges	6	"	.....	3,700,000	
Right-of-way	1,400	acres	250 00	350,000	
	290	"	2,000 00	580,000	
	170	"	10,000 00	1,700,000	
	220	"	25,000 00	5,500,000	
Highway changes	1	mile	20,000 00	20,000	
	3	"	50,000 00	150,000	
River entrances and crossings	.....	.....	.....	300,000	
Paving slopes—canal prism, concrete	102,660	cu. yd.	10 00	1,026,600	
					77,811,100
2. Fryers Island to International Boundary (From Table XII)					18,608,800
Total					96,419,900
Inspection, surveys, superintendence and contingencies					12,013,100
Total for work in Canada					108,433,000
3. International Boundary to Albany (From Table XI)					200,357,300
Inspection, surveys, superintendence, and contingencies					25,084,700
Total for work in United States					225,442,000
Grand total for Route D					333,875,000

TABLE XIV

ESTIMATE OF FIRST COST OF 27-FOOT WATERWAY

Route E.—From Montreal down the St. Lawrence River to Sorel, thence up the Richelieu River to Lake Champlain, thence via Lake Champlain, the Champlain division of the New York State Barge Canal, and the Hudson River to the head of the 27 foot channel at Albany, N.Y.

1. Sorel to Fryers Island on the Richelieu River

Item	Quantity	Unit	Unit Price	Amount	Total
			$ cts.	$	$
Excavation—					
Rock	1,164,000	cu. yd.	5 00	5,820,000	
Earth, dry	5,651,000	"	0 50	2,825,500	
Earth, wet	74,481,000	"	0 40	29,792,400	
Lock at St. Ours	1	No.	.....	4,200,000	
Flight locks at Chambly	.....	.....	.....	11,000,000	
Guard lock	1	No.	.....	3,500,000	
Embankment	2,948,600	cu. yd.	0 35	1,032,000	
Right-of-way	1,300	acres	250 00	325,000	
Bridges	3	No.	.....	3,700,000	
Paving slopes—canal prism, concrete	44,420	cu. yd.	10 00	444,200	
					62,639,100
2. Fryers Island to International Boundary (From Table XII)					18,608,000
Total					81,247,900
Inspection, surveys, superintendence, and contingencies					10,116,100
Total for work in Canada					91,364,000
1. International Boundary to Albany (From Table XI)					200,357,300
Total					200,357,300
Inspection, surveys, superintendence, and contingencies					25,084,700
Total for work in United States					225,442,000
Grand total for route E					316,806,000

TABLE XV

ESTIMATED CAPITAL AND ANNUAL COST OF VARIOUS ROUTES FOR A 27-FOOT DEEP WATERWAY BETWEEN MONTREAL AND THE HUDSON RIVER AT ALBANY, N.Y.

Route A Lake St. Francis to Lake Champlain via Chazy River (Route of U.S. Deep Waterway Board 1900) and thence to Albany.
" B Lake St. Francis to Richelieu River, three miles south of St. Johns, thence to Albany (Canadian Route).
" C Lake St. Louis at Caughnawaga to Fryers Island in Richelieu River and thence to Albany.
" D St. Lawrence River at Longueuil to Fryers Island in Richelieu River and thence to Albany.
" E St. Lawrence River at Sorel at mouth of Richelieu River, up Richelieu River and thence to Albany.

Item	Estimate No. 3 Route A	Estimate No. 4 Route B	Estimate No. 5 Route C	Estimate No. 6 Route D	Estimate No. 7 Route E
Capital Cost—	$	$	$	$	$
Construction	410,243,000	334,442,000	318,508,000	333,875,000	316,806,000
Aids to navigation	50,000	50,000	50,000	50,000	50,000
Interest during construction— (Period=4 yrs. int. at 4%=8%)	32,823,000	26,759,000	25,485,000	26,714,000	25,349,000
Total Capital Cost	443,116,000	361,251,000	344,043,000	360,639,000	342,205,000
Annual Cost—					
Interest on capital=4%	17,724,600	14,450,000	13,761,700	14,425,600	13,688,200
Amortization (at 4%)—					
Fixed structures 50=0·655%	2,678,700	2,084,000	1,969,300	2,103,700	1,974,200
Movable structures 25=2·40%	819,700	1,034,000	1,041,400	947,200	979,000
Main. and oper. of bridges at $10,000	410,000	500,000	480,000	370,000	340,000
Main. and oper. of locks at $50,000	450,000	500,000	450,000	500,000	550,000
Main. of canal reaches at $3,000 per mile	201,000	105,000	156,000	141,000	105,000
Main. of aids to navigation	10,000	10,000	10,000	10,000	10,000
Total Annual Cost	22,294,000	18,683,000	17,868,400	18,497,500	17,646,400

TABLE XVI

LENGTHS AND SAILING TIME IN DAYS VIA PROPOSED ST. LAWRENCE DEEP WATERWAY AND ROUTES INVESTIGATED FOR 27-FOOT WATERWAY FROM MONTREAL TO THE HUDSON RIVER

Route	Character of Navigation Speed Unit	Movable bridges	Locks, 0·7 hrs.	Canal, 5 m.p.h.	Restricted channel, 7 m.p.h.	River, 9 m.p.h.	Open, 10 m.p.h.	Total distance	Equivalent distance, 10 m.p.h.	Sailing time
A. *Via Lake St. Francis—Chazy River Route—*		No.	No.	Miles	Miles	Miles	Miles	Miles	Miles	Days
1. Duluth to New York—										
Duluth to Port Colborne		1	1	1	52	100	817	970		
Port Colborne to Prescott		21	8	27	9	54	157	247		
Prescott to entrance to Beauharnois Canal		2	3	14	11	56	.....	81		
Entrance to Beauharnois Canal to junction with Chazy River route		2	1	8	.....	.....	.....	8		
Beauharnois Canal to Lake Champlain		14	2	39	.....	.....	.....	39		
Lake Champlain to Whitehall		1	.....	.....	38	.....	66	104		
Whitehall to Troy		27	7	28	35	.....	.....	63		
Troy to Albany		6	.....	.....	8	.....	.....	8		
Albany to New York		.....	.....	.....	30	114	.....	144		
Totals		74	22	117	183	324	1,040	1,664	2,049	8·54
2. Montreal to New York—										
Montreal to junction with Chazy River route in Beauharnois Canal		6	5	18	4	9	.....	31		
Beauharnois Canal to New York—see A1		48	9	67	111	114	66	358		
Totals		54	14	85	115	123	66	389	635	2·64
B. *Via Lake St. Francis—Richelieu River Route—*										
1. Duluth to New York—										
Duluth to entrance to Beauharnois Canal—see A1		24	12	42	72	210	974	1,298		
Entrance to Beauharnois Canal to junction with suggested canal		2	1	10	.....	.....	.....	10		
Beauharnois Canal to Richelieu River		21	3	37	.....	.....	.....	37		
Richelieu River to Whitehall		4	.....	.....	62	.....	66	128		
Whitehall to New York—see A1		33	7	28	73	114	.....	215		
Totals		84	23	117	207	324	1,040	1,688	2,091	8·71
2. Montreal to New York—										
Montreal to junction with suggested canal in Beauharnois Canal		6	5	16	4	9	.....	29		
Beauharnois Canal to New York—see B1		58	10	65	135	114	66	380		
Totals		64	15	81	139	123	66	409	668	2·79

TABLE XVI

LENGTHS AND SAILING TIME IN DAYS VIA PROPOSED ST. LAWRENCE DEEP WATERWAY AND ROUTES INVESTIGATED FOR 27-FOOT WATERWAY FROM MONTREAL TO THE HUDSON RIVER—*Concluded*

Route	Character of Navigation Speed Unit	Movable bridges	Locks, 0·7 hrs.	Canal, 5 m.p.h.	Restricted channel, 7 m.p.h.	River, 9 m.p.h.	Open, 10 m.p.h.	Total distance	Equivalent distance, 10 m.p.h.	Sailing time
		No.	No.	Miles	Miles	Miles	Miles	Miles	Miles	Days
C. *Via Caughnawaga–Fryers Island Route*—										
1. Duluth to New York—										
Duluth to Prescott—see A1		22	9	28	61	154	974	1,217		
Prescott to Caughnawaga		6	6	29	15	65	.....	109		
Caughnawaga to Fryers Island		17	2	24	.....	.....	.....	24		
Fryers Island to Whitehall		6	.....	.....	72	.....	66	138		
Whitehall to New York—see A1		33	7	28	73	114	.....	215		
Totals		84	24	109	221	333	1,040	1,703	2,112	8·80
2. Montreal to New York—										
Montreal to Caughnawaga		4	3	11	4	.....	.....	15		
Caughnawaga to New York—see C1		56	9	52	145	114	66	377		
Totals		60	12	63	149	114	66	392	616	2·57
D. *Longueuil—Fryers Island Route*—										
1. Duluth to New York—										
Duluth to Montreal		32	18	68	76	219	974	1,337		
Montreal to Longueuil		.....	.....	.....	3	.....	.....	3	.....	.....
Longueuil to Fryers Island		6	3	19	.....	.....	.....	19		
Fryers Island to New York—see C1		39	7	28	145	114	66	353		
Totals		77	28	115	224	333	1,040	1,712	2,156	8·98
2. Montreal to New York—see D1		45	10	47	148	114	66	375	568	2·37
E. *Sorel—Richelieu River Route*—										
1. Duluth to New York—										
Duluth to Montreal		32	18	68	76	219	974	1,337		
Montreal to Sorel		.....	.....	.....	37	9	.....	46		
Sorel to Fryers Island		5	4	7	43	.....	.....	50		
Fryers Island to New York—see C1		39	7	28	145	114	66	353		
Totals		76	29	103	301	342	1,040	1,786	2,259	9·41
2. Montreal to New York—see E1		44	11	35	225	123	66	449	671	2·80

TABLE XVII

DEVELOPMENT OF TRAFFIC ON THE NEW YORK STATE CANALS, WELLAND, ST. LAWRENCE, AND CHAMBLY CANALS

(Amount expressed in short tons)

Year	New York State Canals	Welland Canal	St. Lawrence Canals*	Chambly Canal
1880	6,437,656	819,934	.....	.....
1890	5,246,102	1,016,165	.....	.....
1900	3,345,941	719,360	1,309,066	348,561
1910	3,073,412	2,326,390	2,760,752	669,299
1920	1,421,434	2,276,072	3,067,962	325,322
1928	3,089,998	7,439,617	8,411,542	162,304
1929	2,876,160	4,769,866	5,718,851	123,077
1930	3,605,457	6,087,910	6,179,023	99,998
1931	3,722,012	7,273,886	6,036,980	50,336
1932	3,643,433	8,537,460	6,693,800	29,350
1933	4,074,002	9,194,130	6,981,064	26,912
1934	4,142,728	9,280,452	6,660,052	33,326
1935	4,489,172	8,953,383	6,873,655	44,200

SOURCE: 1880–1920, House Document No. 288, 69th Congress, 1st Session; 1928–1935, Annual Report, Superintendent, Department of Public Works, New York State; and Canal Statistics, Dominion Bureau of Statistics, Ottawa, Ontario.

* Includes through and way traffic.

TABLE XVIII

INTERSTATE AND INTRASTATE TONNAGE TRANSPORTED THROUGH NEW YORK STATE BARGE CANAL SYSTEM DURING 193

Origin	Destination	Tons Transported	Per cent
Interstate—			
Points outside New York State	Points beyond New York State	475,912	10·60
Points outside New York State	Points within New York State	1,058,958	23·59
Points within New York State	Points beyond New York State	626,379	13·95
Points within New York State	New York Harbour (points in New Jersey)	60,105	1·34
New York Habour (points in New Jersey).	Points within New York State	540,173	12·03
		2,761,527	61·51
Intrastate		1,727,645	38·49
Total interstate and intrastate		4,489,172	100·00

SOURCE: Annual Report, Superintendent, Department of Public Works, State of New York.

TABLE XIX

DIRECTIONAL FLOW OF THE TEN PRINCIPAL COMMODITIES TRANSPORTED THROUGH THE NEW YORK STATE BARGE CANAL SYSTEM, SEASON 1934

Rank	Commodity	Per cent of total freight transported	Short tons transported		
			East	West	Total
1	Petroleum and its products	41·00	85,916	1,612,815	1,698,731
2	Wheat	15·93	611,631	48,575	660,206
3	Grain, (corn, rye, oats and barley)	6·60	169,194	103,948	273,142
4	Chemicals, drugs, etc	5·92	244,237	1,060	245,297
5	Sugar	4·81	9	199,340	199,349
6	Sulphur	4·32	.....	178,782	178,782
7	Fertilizer	3·46	23,104	124,552	147,656
8	Scrap iron	2·20	25,113	65,862	90,975
9	Flour	1·90	75,346	3,496	78,842
10	Sand, stone and gravel	1·16	31,510	16,565	48,075
	Total 10 principal commodities	87·40	1,266,060	2,354,995	3,621,055

SOURCE: Annual Report, Superintendent, Department of Public Works, State of New York.

TABLE XX

DIRECTIONAL FLOW OF TRAFFIC ON THE NEW YORK STATE BARGE CANAL SYSTEM

(Quantities expressed in tons)

Year	Erie and Oswego Canals*			Champlain Canal		
	Total tons	East	West	Total tons	North	South
1926	2,002,116	1,027,142	974,974	367,251	201,862	165,389
1927	2,170,096	1,070,248	1,099,848	411,796	195,563	216,233
1928	2,674,281	1,461,111	1,213,170	415,717	159,526	256,191
1929	2,565,934	1,263,447	1,302,487	310,226	120,382	189,884
1930	3,292,715	1,668,845	1,623,870	312,742	112,625	200,117
1931	3,503,834	1,714,324	1,788,510	218,178	64,328	153,850
1932	3,433,400	1,674,331	1,759,069	210,033	42,667	167,366
1933	3,847,856	1,579,359	2,268,497	226,146	49,499	176,647
1934	3,867,941	1,458,375	2,409,566	274,787	47,592	227,195
1935	4,137,704	1,372,548	2,765,156	351,468	115,767	235,701

TOTAL FOR BARGE CANAL SYSTEM

Year	Total Tons	East	Per cent	West	Per cent
1926	2,369,367	1,229,004	51·87	1,140,363	48·13
1927	2,581,892	1,265,811	49·03	1,316,081	50·97
1928	3,089,998	1,620,637	52·45	1,469,361	47·55
1929	2,876,160	1,383,829	48·11	1,492,331	51·89
1930	2,605,457	1,781,470	49·41	1,823,987	50·59
1931	3,722,012	1,779,652	47·81	1,942,360	52·19
1932	3,643,433	1,716,998	47·13	1,926,435	52·87
1933	4,074,002	1,628,858	39·98	2,445,144	60·02
1934	4,142,728	1,505,967	36·55	2,636,761	63·65
1935	4,489,172	1,488,315	33·15	3,000,857	66·85

SOURCE: Annual Report for 1935, Superintendent, Department of Public Works, State of New York.
* Includes tonnage moved on Cayuga-Seneca Canal amounting to 4·8 p.c. of total.

TABLE XXI

DIRECTIONAL FLOW OF THROUGH TRAFFIC ON THE ST. LAWRENCE CANALS IN 1935, BY CLASSES AND BY PRINCIPAL COMMODITIES IN EACH CLASS

(Quantities expressed in tons)

Class and principal commodity	From Canadian to Canadian ports		From Canadian to to U.S. Ports		From U.S. to U.S. ports		From U.S. to Canadian ports		Total tons		Grand Total
	West	East	West	East	West	East	West	East	West	East	
Agricultural products—											
Wheat		1,226,709		1,908						1,228,617	1,228,617
Corn	96,051	756	104,858					245,899	200,909	246,655	447,564
Flour	410	144,241		12,063		7,164		2,991	410	166,459	166,869
All other agricultural products	46,962	319,374	63,624	73		2,640		53,161	110,586	375,248	485,834
Animal products—											
Fish					400				400		400
Meat, etc						179		156		335	335
All other animal products	1,595	3,513							1,595	3,513	5,108
Manufactures—											
Gasoline, petroleum and other oils	659,755	33,574	5,998	242	5,675		1,730		673,158	33,816	706,974
Sugar	128,118	359	2,225		6,679				137,022	359	137,381
Wood pulp	25,852		335,956		16,065				377,873		377,873
All other manufactures	254,892	199,102	115,745	8,632	41,974	11,780	13,372	41,423	425,983	260,937	686,920
Products of forests—											
Pulpwood	285,168		236,419				2,160		523,747		523,747
All other products of forests	5,631	137	2,401					60	8,032	197	8,229
Products of Mines—											
Hard coal	411,528		3,010				2,671	4,855	417,209	4,855	422,064
Soft coal	101,711	2,150	2,750			6,838		369,822	104,461	378,810	483,271
All other products of mines	82,478	5,286	87,683		6,734		715	2,100	177,610	7,386	184,996
Total	2,100,151	1,935,201	970,669	22,918	77,527	28,601	20,648	720,467	3,158,995	2,707,187	5,866,182

SOURCE: Canal Statistics, Dominion Bureau of Statistics, Ottawa, Ontario.

TABLE XXII

DIRECTIONAL FLOW OF TRAFFIC ON THE WELLAND CANAL IN 1935 BY CLASSES AND BY PRINCIPAL COMMODITIES IN EACH CLASS

(Quantities expressed in tons)

Class and principal commodity	From Canadian to Canadian ports		From Canadian to U.S. ports		From U.S. to U.S. Ports		From U.S. to Canadian ports		Total tons		Grand Total
	West	East	West	East	West	East	West	East	West	East	
Agricultural products—											
Wheat	19,892	1,524,754	11,340	.....	1,080	18,483	.....	303,960	32,312	1,847,197	1,879,509
Corn	18,565	686	106,174	.....	2,865	5,348	.....	.....	127,604	6,034	133,638
All other agricultural products	5,147	486,686	104,179	9,679	9,436	30,387	.....	56,674	118,762	583,426	702,188
Animal products—											
Fish	.....	.....	.....	.....	373	.....	.....	.....	373	.....	373
Meats, etc	.....	.....	.....	.....	.....	179	.....	156	.....	335	335
Manufactures—											
Gasoline, petroleum and other oils	180,204	313,590	3,913	1,592	115,302	14,257	.....	120,687	299,419	450,126	749,545
Wood pulp	14,261	2,800	333,531	.....	15,361	.....	.....	.....	363,153	2,800	365,953
All other manufactures	250,838	139,764	234,091	1,932	183,344	167,935	27,647	96,063	695,920	405,694	1,101,614
Products of forests—											
Pulpwood	288,345	.....	145,861	.....	504	.....	2,160	.....	436,870	.....	436,870
All other products of forests	2,972	3,223	.....	.....	1,160	74	.....	60	4,132	3,357	7,489
Products of Mines—											
Hard coal	6,148	.....	1,460	.....	.....	.....	.....	2,127	7,608	2,127	9,735
Soft coal	38,848	.....	8,241	.....	1,450	102,110	1,178	2,646,422	49,717	2,648,532	2,698,249
Ores and other mine products	81,368	23,131	96,855	224	7,250	31,248	2,140	625,669	187,613	680,272	867,885
Total	906,588	2,494,634	1,045,645	13,427	338,125	370,021	33,125	3,751,818	2,323,483	6,629,900	8,953,383

SOURCE: Canal Statistics, Dominion Bureau of Statistics, Ottawa, Ontario.

TABLE XXIII

DIRECTIONAL FLOW OF TRAFFIC ON THE CHAMBLY CANAL AND ST. OURS LOCK IN 1935 BY CLASSES AND BY PRINCIPAL COMMODITIES IN EACH CLASS

(Quantities expressed in tons)

Class and principal commodity	From Canadian to Canadian ports		From Canadian to U.S. ports		From U.S. to U.S. ports		From U.S. to Canadian ports		Total tons		Grand Total
	South	North	South	North	South	North	South	North	South	North	
Agricultural products—											
Hay and straw			880						880		880
Fruits and vegetables	20	105							20	105	125
Animal products—											
Fish			26						26		26
Meats, etc		280								280	280
Manufactures—											
Paper			11,239						11,239		11,239
All other manufactures	6,270	473						326	6,270	799	7,069
Products of forests—											
Lumber, etc			4,360						4,360		4,360
Products of mines—											
Hard coal	50							2,114	50	2,114	2,164
Soft coal	285							2,123	285	2,123	2,408
Ores and other mine products	12,793	70						2,805	12,793	2,875	15,668
Total	19,418	928	16,505					7,368	35,923	8,296	44,219

SOURCE: Canal Statistics, Dominion Bureau of Statistics, Ottawa, Ontario.

TABLE XXIV.

ESTIMATED TONNAGE OF IMPORTS AND EXPORTS TO AND FROM CANADA AT CERTAIN RAIL PORTS OF ENTRY

Year	Rail ports between Megantic and Cornwall		Niagara Frontier Rail Ports		Total
	Imports	Exports	Imports	Exports	
1929	2,472,000	3,309,000	5,303,000	1,208,000	12,292,000
1930	2,110,000	3,001,000	4,433,000	910,000	10,454,000
1931	1,585,000	2,322,000	3,122,000	649,000	7,678,000
1932	1,216,000	1,663,000	2,233,000	521,000	5,633,000
1933	1,156,000	1,713,000	1,951,000	538,000	5,358,000
1934	1,401,000	1,867,000	2,250,000	578,000	6,096,000
Average	1,657,000	2,312,000	3,215,000	734,000	7,918,000

TABLE XXV.

ACTUAL AND EQUIVALENT DISTANCES FROM MONTREAL TO VARIOUS PORTS VIA GULF OF ST. LAWRENCE

No.	Route — Montreal to—	Actual distance in statute miles				Equivalent distance at 10 m.p.h. miles
		Restricted channel at 7 m.p.h.	River at 9 m.p.h.	Lake, ocean or open at 10 m.p.h.	Total	
1	Trans-Atlantic Ports—					
a	Liverpool	129	901	2,059	3,089	3,244
b	Gibraltar	129	901	2,641	3,671	3,826
c	Cape Town	129	901	7,155	8,185	8,340
2	East Coast of South America—Buenos Aires	129	901	6,364	7,394	7,549
3	West Indies—Barbados	144	901	2,014	3,059	3,221
4	Bermuda	144	901	741	1,786	1,948
5	Central America, West Coast of South America and points through Panama Canal—					
	Panama Canal Zone	144	901	2,643	3,688	3,850
6	Cuba—Havana	144	901	1,805	2,850	3,012
7 a	U.S. Atlantic Ports—Portland Me	144	901	343	1,388	1,550
b	Boston, Mass	144	901	391	1,436	1,598
c	New York, N.Y	144	901	626	1,671	1,833
d	Norfolk, Va	144	901	855	1,900	2,062

TABLE XXVI.

ACTUAL AND EQUIVALENT DISTANCES FROM MONTREAL TO VARIOUS PORTS VIA SUGGESTED 27-FOOT MONTREAL-LAKE CHAMPLAIN-HUDSON RIVER WATERWAY

No.	Route — Montreal to—	Number of locks at 0·7 hours each	Actual distance in statute miles					Equivalent distance at 10 m.p.h. miles
			Canal at 5 m.p.h.	Restricted channel at 7 m.p.h.	River at 9 m.p.h.	Lake, ocean or open at 10 m.p.h.	Total	
1	Trans-Atlantic Ports—							
a	Liverpool	11	35	225	123	3,637	4,020	4,242
b	Gibraltar	11	35	225	123	3,734	4,117	4,339
c	Cape Town	11	35	225	123	7,880	8,263	8,485
2	East Coast of South America—Burnos Aires	11	35	225	123	6,827	7,210	7,432
3	West Indies—Barbados	11	35	225	123	2,172	2,555	2,777
4	Bermuda	11	35	225	125	850	1,233	1,455
5	Central America, West Coast of South America and points through Panama Canal—Panama Canal Zone	11	35	225	123	2,389	2,772	2,994
6	Cuba—Havana	11	35	225	123	1,432	1,815	2,037
7 a	U.S. Atlantic Ports—Portland, Me	12	43	230	123	394	790	1,029
b	Boston, Mass	12	43	230	123	318	714	953
c	New York, N.Y.	11	35	225	123	66	449	671
d	Norfolk, Va	11	35	225	123	405	788	1,010

TABLE XXVII.

ESTIMATED SAVINGS IN UNIT TRANSPORTATION COSTS THAT WOULD BE EFFECTED BY 27-FOOT MONTREAL-LAKE CHAMPLAIN-HUDSON RIVER WATERWAY

(Based on transportation cost of 0·062c. per ton mile)

No.	Route — Montreal to—	Distance in Equivalent statute miles			Gross saving per ton	Gross saving per vessel 3,800 cargo tons	Additional pilotage dues	Net saving	
		Via Gulf of St. Lawrence and Atlantic	Via 27-foot waterway	Saving effected miles				Per vessel trip	Per ton
1	Trans-Atlantic ports—								
a	Liverpool	3,244	4,242	.....	No saving				
b	Gibraltar	3,826	4,339	.....	Shortest route via Gulf of St. Lawrence and Atlantic				
c	Cape Town	8,340	8,485						
2	East Coast of South America—Buenos Aires	7,549	7,432	117	0,073	$ 277 00	$160 00	$ 117 00	$0 03
3	West Indies—Barbados	3,221	2,777	444	0·276	1,049 00	160 00	889 00	0 23
4	Bermuda	1,948	1,455	493	0·306	1,163 00	160 00	1,003 00	0 26
5	Central America, West Coast of South America and points through Panama Canal—Panama Canal Zone	3,850	2,994	856	0·531	2,018 00	160 00	1,858 00	0 49
6	Cuba—Havana	3,012	2,037	975	0·605	2,299 00	160 00	2,139 00	0 56
7 a	U.S. Atlantic Ports—Portland, Me	1,550	1,029	521	0·323	1,227 00	160 00	1,067 00	0 28
b	Boston, Mass	1,598	953	645	0·400	1,520 00	160 00	1,360 00	0 36
c	New York, N.Y	1,833	671	1,162	0·721	2,740 00	160 00	2,580 00	0 68
d	Norfolk, Va	2,062	1,010	1,052	0·653	2,481 00	160 00	2,321 00	0 61

NOTE.—Distances in equivalent miles from Tables XXV and XXVI.

APPENDIX B

ESTIMATED SAVINGS IN UNIT TRANSPORTATION COSTS—12-FOOT WATERWAY

1. The saving in transportation costs that would be effected by the construction of a 12-foot waterway to connect the St. Lawrence and Hudson rivers, would be the difference between the cheapest cost of transportation existing at the present time and the cost of transportation by the suggested waterway.

2. As newsprint paper will comprise the bulk of the estimated traffic on the suggested 12-foot waterway, the saving in unit cost of transportation on this commodity is estimated hereafter, and this unit saving is used as the basis on which to estimate the total savings in transportation costs that might be effected.

3. Practically no newsprint is shipped by rail during the navigation season from the mills in the St. Lawrence River area below Montreal to New York or other Atlantic Ports. Newsprint now moves from Donnacona, Quebec, to New York via the existing Richelieu River Canal system and Lake Champlain and also via the St. Lawrence River canals to Oswego on Lake Ontario and thence through the New York State canals and Hudson river. Other paper mills located in the St. Lawrence River area below Montreal ship paper to New York and other United States Atlantic ports via the Gulf of St. Lawrence and Atlantic. The railways do not offer a competitive rate between the areas considered. The rate on carload lots of newsprint between Donnacona and New York is $0.32 per 100 pounds or $6.40 per ton, while the cost of water transportation via Oswego or by the Gulf of St. Lawrence, as estimated hereafter is $1.19 or $1.03 per ton respectively. The rail rate includes loading and unloading charges but even when these charges are considered it will be seen that the rail rate is not the competitive rate.

4. Actual costs of transportation either on the present Richelieu River Canal system or on the route through the St. Lawrence canals to Oswego and thence by the New York State Canals are not available. The published rates on wheat from Buffalo to New York via the New York State Barge Canal, however, provide a method by which the ton mile cost of transportation via a 12-foot waterway, comparable to that considered in this report, can be calculated.

5. The actual distance from Buffalo to New York via the New York State Barge Canal is 507 miles. This distance expressed as open water mileage reduced on the basis of locks at 0·5 hours each; canal reaches at the rate of 5 miles per hour; restricted channels, 7 miles per hour; open river, 9 miles per hour; and lake or open water, 10 miles per hour; is equivalent to 954 miles.

6. The average water rate charged on wheat from Buffalo to New York during the period 1931 to 1935 was 2·86 cents per bushel which is equivalent to $0·953 per ton or 0·10 cents per ton mile based on equivalent mileage. This represents the " rate " per ton mile and if used as " cost," is admittedly too high by the amount of profit included in the rate charged. It is believed, however, that this figure represents actual cost as near as can be determined as the rates charged during the last 5 years have included very little profit.

7. The distance between Donnacona, Quebec and New York via the St. Lawrence canals, Oswego, and the New York State canals reduced to equivalent mileage is 1,194 miles. The estimated cost of transportation between these points via this route at 0·10 cents per ton mile is $1·194 per ton. The cost via this route must be very close to that by deeper draft vessels via the Gulf of St. Lawrence and the Atlantic because most of the paper from the area considered moves at the present time by this latter route. The fact that these costs are comparable is furnished by the application of the cost per ton-mile of transportation by deep draft vessel as estimated hereafter in this report at 0·062 cents per mile to the equivalent distance between these points via the Gulf of St. Lawrence, i.e., 1,657 miles. This would show the actual cost via the deep water route as $1.03 per ton.

8. The total saving per ton of traffic that would be effected by the suggested twelve-foot waterway will be directly proportional to the saving in distance reduced to equivalent mileage on the basis set out above. As most of the estimated commerce will move between the St. Lawrence River and New York, the unit saving used hereafter is based on the saving in distance between Montreal and New York as follows:—

Route	Distance in miles		
	Actual	Equivalent	Saving
Montreal to New York—			
Via Oswego	566	1,019	
Via Sorel and suggested route	449	667	352
Unit saving = 352 miles at $0.10		$0.35 per ton	

ESTIMATED SAVINGS IN UNIT TRANSPORTATION COSTS— 14-FOOT WATERWAY

9. The provision of a 14-foot depth in all channels on the suggested waterway will result in increased carrying capacity per vessel on the route which in turn will result in a decrease in the cost of transportation per ton mile. This reduction in cost will not be proportional to the increased carrying capacity on account of the increased cost of operation due to the increased draft. It is estimated that the cost of transportation, however, due to the 14-foot depth, will be reduced from 0·10 cents as derived in paragraph 6 as the cost via the 12-foot waterway to 0·085 cents per ton mile.

10. On the basis of 0·085 cents per ton mile, the unit saving effected by the construction of a 14-foot waterway will be as follows:—

Montreal to New York—

Cost per ton via Oswego=1,019 miles at 0·10c.=$1·019 per ton
Cost per ton via Sorel = 667 miles at 0·085c.= 0·567 per ton

Unit saving..... 0·452 per ton
say.....$0·45 per ton

ESTIMATED SAVINGS IN UNIT TRANSPORTATION COSTS— 27-FOOT WATERWAY

11. The saving in transportation costs that would be effected by the construction of a 27-foot waterway from Montreal through Lake Champlain to the Hudson river would be that due solely to the saving in time to a vessel effected by traversing the suggested waterway as compared with traversing the existing deep water route via the Gulf of St. Lawrence and the Atlantic.

12. As a basis for calculating the savings possible in operating a typical cargo vessel via the suggested Montreal-Lake Champlain-Hudson River Waterway as compared with the open route via the St. Lawrence and Atlantic, the following vessel costs are taken from a report on the St. Lawrence Deep Waterway Project prepared by the United States War Department and included in Senate Document No. 116, 73d Congress, 2d Session.

Description of Typical Vessel—

Tonnage—Deadweight	7,825 tons
Gross	5,117 tons
Net	3,124 tons
Average freight cargo carried	3,800 tons
Total period of operation per year	330 days
Load draft	24 ft. 9 in.
Speed (open water)	10 miles per hr.
Value per deadweight ton	$90 00

Cost per Day—

Voyage expense (fuel, wages, subsistence, supplies, repairs, etc.) at sea	$ 315 37
Insurance	
Hull, 4½ per cent on value of $90, per deadweight ton per day	96 03
Protection indemnity, $1 per gross ton per year reduced to per day basis	15 51
Depreciation—5 per cent on value of $90 per deadweight ton, reduced to per day basis	106 70
Administration expenses at $1,000 per month	33 00
Total cost per day	$ 566 61

Cost per Mile—

At ten miles per hour (open water)—cost per mile	$ 2 36

Cost per Ton Mile—

With average freight cargo carried=3,800 tons.	
Cost per Ton Mile	0·062c

13. Confirmation of this figure is obtained by analysing the average rates charged on wheat from Montreal to Liverpool during 1934 and 1935, as follows:

Year	Cents per bushel	Dollars per ton	Cents per ton-mile (Distance =3,089 miles)
	cents	$	
1934	5·36	1·79	
1935	6·11	2·04	
Average		1·915	=0·062c.

14. In estimating the savings per ton that would be effected by the suggested 27-foot waterway, it has been assumed that cargo and hull insurance via the suggested route would be the same as via the St. Lawrence River and Atlantic.

15. It is estimated that pilotage dues would be greater via the suggested route than via the existing St. Lawrence River route by the amount shown below:—

Route	Pilotage dues per vessel of 25 ft. draft	
Via suggested route—		
Sandy Hook to New York	$ 122 00	
New York to Albany	57 50	
Albany to Montreal—305 miles (based on comparison of distance with that from Montreal to Father Point on St. Lawrence)	176 00	$ 355 50
Via St. Lawrence River—		
Father Point to Montreal—342 miles		197 00
Additional Pilotage dues		$ 158 50
		say $ 160 00

16. In estimating the saving in unit cost of transportation effected by the 27-foot waterway, all distances between various ports have been reduced to equivalent distances of open water on the basis of locks at 0·7 hours each; canal reaches at the rate of five miles per hour; restricted channels, seven miles per hour; open river, nine miles per hour; and lake, ocean or open water, ten miles per hour. The actual and equivalent distances between Montreal and various points by the existing route via the Gulf of St Lawrence and Atlantic and via the suggested waterway are shown on Tables XXV and XXVI of Appendix A.

17. Table No. XXVII, Appendix A, shows the estimated savings per ton of freight carried to or from Montreal from or to various points by use of the suggested waterway. These savings would also apply to freight destined to or from any points on the Great Lakes, and would be over and above any saving effected by the St. Lawrence Deep Waterway itself.

18. The unit savings shown on Table XXVII are summarized as follows:—

From or to Montreal and great lake ports to and from	Estimated saving in cost of transportation per ton	
Transatlantic points	No saving	
East coast of South America	$ 0 03	
West Indies or Bermuda (average)	0 25	
Central America and points through Panama Canal	0 49	
Cuba	0 56	
U.S. Atlantic Ports		
Ports north of New York (average)	0 32	
New York and ports south (average)	0 65	
Estimated weighted average	$ 0 48	per ton

POTENTIAL CANADIAN COMMERCE

19. *General.*—As stated in paragraph 87 of the report, all commerce moving during the navigation season between points on routes that would be benefited by the suggested waterway might be considered as "potential" commerce. It was pointed out, however, that there are many factors that must be taken into consideration, all of which tend to reduce the actual tonnage that might be called "potential."

20. As an illustration of the above, an analysis of the total import and export tonnage of Montreal Harbour during 1935 is shown below:—

(*a*)	Total import and export tonnage.....	7,964,926 tons
(b)	Total originating at or destined to points on routes that might be benefited from suggested waterway.	2,948,680 tons
(*c*)	Total of (*b*) carried in vessels of greater than 26 foot draft. This was mostly oil, gasoline, and molasses carried in tankers.....	2,202,478 tons
(*d*)	Total of (*b*) carried in vessels of 26 foot draft or less	746,202 tons
(*e*)	Total of (*d*) carried in vessels that stopped en route at either Boston, Halifax, Sydney, or other ports in Maritime Provinces.....	228,615 tons
(*f*)	Maximum that could possibly have used suggested 27-foot waterway (*d-e*).....	517,587 tons

21. It is not believed that the estimated unit savings are such as will attract traffic destined to or originating at points not adjacent to water transportation, i.e. the cost of two transfers between rail and vessel will be greater than the unit saving effected in transportation costs. The average cost of transferring package freight from rail to vessel or vessel to rail is about $1.75 per ton.

22. Due to the cost of transshipment and to the cheaper unit cost of transportation by deep draft vessel than by shallow canal draft vessel, it is believed that the 12-foot or 14-foot waterway will not attract traffic destined to or originating at St. Lawrence River ports from or to points that can be reached direct by deep draft vessels. As a basis for this conclusion, the costs of transporting one ton of freight from Havana, Cuba, to Montreal direct by deep draft vessel via the Atlantic and Gulf of St. Lawrence and by canal vessel via New York and the suggested 14-foot waterway are estimated below:—

COSTS OF TRANSPORTING 1 TON OF FREIGHT—HAVANA, CUBA, TO MONTREAL

A. Via 24′ 9″ draft vessel direct (cargo tonnage=3,800 tons) Havana to Montreal—Equivalent distance=3,012 miles.

	Per ton
Cost of transportation=3,012 miles at 0·062 cents..	$1 87
Pilotage dues at $197 per trip=..	0 05
Total..	$1 92

B. Via 24′ 9″ draft vessel to Albany and transfer at Albany to 12 foot draft vessel for Montreal. Havana to Albany—Equivalent distance=1,536 miles.

	Per ton
Cost of transportation=1,536 miles at 0·062 cents..	$0 95
Transfer at Albany..	1 75
Albany to Montreal—Equivalent distance=497 miles.	
Cost of transportation=497 miles at 0·085 cents..	0 42
Pilotage dues—Sandy Hook to Albany=$179.50..	0 05
Total..	$3 17

23. With a 27-foot waterway, it may be assumed that some of the waterborne freight destined to or from St. Lawrence River ports from or to points south of New York might use the waterway with a consequent saving in sailing time.

24. That sailing distance is not the main factor in determining the routing of waterborne freight is borne out by the fact that practically no imports into Lake Ontario ports or into ports west of Lake Ontario from points south of New York enter Lake Ontario by the Hudson River and New York State Barge Canal

to Oswego. This all-American route to Lake Ontario is 780 miles shorter than via the Atlantic ocean, gulf and river St. Lawrence while the length of its restricted channels and canals is 100 miles shorter than those of the St. Lawrence route. The suggested 12-foot or 14-foot improvement to the Richelieu River route would only shorten the total distance from points south of New York to Lake Ontario ports by about 475 miles as compared with the existing Gulf and St. Lawrence route, while the length of restricted channels on it would be about 85 miles greater than those encountered on the Atlantic-St. Lawrence route.

25. *West Indies, Bermuda, Cuba, Venezuela, and British Guiana Trade.*—Practically all imports from and exports to these countries from eastern Canada are carried in either combination passenger and freight vessels, in vessels that stop at North Atlantic ports to load or discharge part cargoes, or in small schooners. The first mentioned vessels depend on the sea voyage for their popularity as tourist vessels and obviously would not be attracted to the suggested waterway. The second mentioned vessels could not use the waterway any more than the small schooners which by their nature must stay in open waters. For these reasons a very small proportion of the trade between these countries and Canada can be considered as potential commerce for the suggested waterway. The main imports into Canada from these countries are fruit, sugar, molasses, cocoa beans and coffee. The main exports from Canada to these countries are wheat, flour, and fish.

26. In addition to the above commodities, the potential commerce of the following has been studied:

Pulpwood	Lumber	Sulphur
Wood-pulp	Iron ore	Hay
Paper	Coal	Sand and stone
Petroleum	Fertilizers	General merchandise

27. *Fruit and Vegetables.*—No fruit or vegetables are considered as potential traffic for the suggested waterway due to the reasons set forth in the paragraph on West Indies and Bermuda trade.

28. *Sugar and Molasses.*—Canada's main imports of sugar and molasses originate in the British West Indies, Cuba, and the Fiji Islands. As in the case of fruit, the largest portion of these imports would not be available for transit through the suggested waterway.

In 1934, Canada's imports of sugar and molasses were as follows:

From West Indies, Guiana, or Venezuela	188,845 tons
From Cuba	43,978 tons
From Fiji Islands	72,336 tons
Total	305,159 tons

The total imports of sugar by water at Montreal and Quebec in the same years were as follows:

	Tons
At Montreal	257,588
At Quebec	10,871
Total	268,459

29. For the reasons hereinbefore set out, it is impossible to determine definitely how much of this would be potential commerce for the suggested waterway, but for the purposes of this analysis a maximum of 125,000 tons per year is assumed as potential traffic for a 27-foot waterway. No tonnage in these commodities is considered as potential to either a 12-foot or 14-foot waterway.

30. *Cocoa Beans and Coffee.*—Canada's total imports in 1934 of these commodities from countries on routes that might benefit from the suggested waterway were as follows:—

	Cocoa Beans Tons	Coffee Tons
From British Guiana and Venezuela	8,803	4,383
From Central America	46	3,409
Total	8,849	7,792

Total receipts of the above commodities by water at Montreal and Quebec during 1934 were as follows:—

	Tons
Cocoa Beans	6,182
Coffee	4,778
Total	10,960

31. The greater portion of these commodities enter Canada in the same manner as fruit, sugar and molasses, i.e., in vessels that it is not believed would use the suggested waterway. The total estimated potential commerce for a 27-foot waterway is about 8,000 tons per year. For reasons herebefore discussed, none of this tonnage is considered as potential to a 12-foot or 14-foot waterway.

32. *Wheat Flour.*—Canada's exports of wheat flour to the British West Indies, Venezuela, and Cuba during 1934 amounted to 104,181 tons. This was mostly transported in the combination passenger and freight vessels and small schooners previously mentioned and it is not estimated that any of this can be considered as potential commerce for the suggested waterway.

33. *Fish.*—Next to wheat flour, fish provides the largest tonnage of Canada's exports to the West Indies. Practically all of this originates in the Maritime Provinces and would not be available for transit through the suggested waterway.

34. *Pulpwood.*—Up until 1915 pulpwood comprised between 62 and 78 per cent of the total traffic on the present Richelieu River canal system from Canadian to United States ports and varied from a maximum of 399,000 tons in 1907 to a minimum of 151,000 tons in 1915. Since 1915 the annual traffic in pulpwood steadily declined and ceased entirely in 1931. The discouragement of the exports of pulpwood cut from Crown lands by the various Canadian Provincial Governments and the consequent location of paper mills in Canada by United States companies has no doubt been responsible for the decrease in traffic in pulpwood. There is no reason to believe that the construction of a deeper waterway will promote any traffic in pulpwood as the loss of this business is due to causes other than transportation costs.

35. *Wood Pulp.*—Wood pulp has been suggested as a commodity that might move from Canada to the United States via the suggested waterway. In 1921, Canada furnished about 58 per cent of the total imports of wood pulp into the United States. This percentage remained fairly constant until 1927, since when it has gradually decreased until in 1934 Canada supplied about 30 per cent, Sweden 45 per cent and other European countries the balance.

36. According to a report on " The Pulp and Paper Industry 1934," published by the Dominion Bureau of Statistics, Canada, in 1908, exported two-thirds of its wood pulp without further manufacture into paper or other pulp products. The greater part of the total production was exported until 1913, since when more and more of the pulp produced has been retained in Canada for further manufacture, until in 1934 only 16·7 per cent was exported, this small percentage

being mechanically prepared pulp of high value. In 1927, Canada occupied second place among the world's exporters of wood pulp, being surpassed in this respect by Sweden alone. In 1929, Canada had dropped to fourth place, giving way to Norway and Finland and has since remained in this position. The decline in Canada's exports of wood pulp is largely due to the fact that a larger proportion of the wood pulp manufactured is being used in the pulp and paper industry in Canada in the manufacture of paper and other pulp products and consequently the products of this important industry are being exported in the manufactured form of paper rather than the partly manufactured form of pulp.

37. The total exports of wood pulp from Canada to the United States for the years 1928-1935 were as follows:—

Year	Exports of Wood Pulp from Canada to United States Tons
1928	723,895
1929	711,430
1930	646,996
1931	491,731
1932	362,692
1933	486,580
1934	478,959
1935	530,671

38. At the present time, Norwegian and Swedish vessels entering the Great Lakes carry wood pulp from Europe to United States Great Lakes ports, passing en route the pulp and paper manufacturing plants located on the St. Lawrence River below Montreal that might be expected to provide traffic for the suggested waterway. Other imports of wood pulp from Europe to the United States are carried in deeper draft vessels that cross the Atlantic for grain or general cargoes from the United States and no doubt the freight rates charged on the westbound cargoes are either below cost or give a very small margin of profit above the actual cost of transportation.

39. For the above reasons, this analysis does not include wood pulp as potential commerce for the suggested waterway.

40. *Paper.*—An enlargement of the existing waterway between the St. Lawrence and Hudson Rivers might result in an increase in the waterborne shipment of newsprint paper to the United States Atlantic Coast area. This increase might be partly at the expense of the railways and partly due to increase in exports of newsprint from the mills located on water in the lower St. Lawrence area. The mills in the Hull-Gatineau district which now supply about 63 per cent of the newsprint tonnage shipped via the Richelieu River canal system, would benefit very little from an increase in permissible draft for navigation as water transport from these mills would still be limited by the 9-foot depth in the Ottawa River canals. The mills above Montreal would not benefit from a 12- or 14-foot waterway as they have available at the present time a shorter route of 12-foot depth via Oswego and the New York State Barge Canal than would be provided by the enlarged Richelieu River route. A 27-foot waterway on the Richelieu River route in conjunction with the proposed St. Lawrence Deep Waterway might be of benefit to these latter mills but if so, would only result in greater competition with the Quebec mills.

41. During the period 1921-1934, Canada supplied about 88 per cent of the total newsprint imported into the United States. Finland, Norway, and Sweden supplied about 7 per cent, Newfoundland about 4 per cent, and other countries 1 per cent. Imports into the United States during 1934 were as follows:—

Country of Origin	Imports of Newsprint into the United States			
Canada	1,956,037	tons	= 88·6	per cent
Finland, Norway and Sweden	141,313	"	= 6·4	"
Newfoundland	106,598	"	= 4·8	"
Other countries	5,750	"	= 0·2	"
Total	2,209,698	"	=100·0	"

Of the total imports into the United States in 1934, 536,000 tons were imported through Atlantic and Gulf of Mexico ports. This must have included that imported from Europe and Newfoundland, amounting to 248,000 tons. Therefore, the maximum that could have been imported from Canada into this area was about 290,000 tons. Based on mill capacity it might be assumed that mills in Quebec located so as to take advantage of water transportation furnished about 150,000 tons of the total imports of paper into the area considered.

42. Most of the mills located at sites adjacent to water transportation now ship most of their export tonnage to points similarly located, by deep draft vessels via the St. Lawrence and Atlantic during the navigation season. Some of these companies operate their own vessels. It is obvious that the construction of a 12 or 14-foot waterway would not divert any of this traffic from the existing routes.

43. The construction of a 12 or 14-foot waterway would not enable the Quebec mills to displace the exports from Newfoundland or from Europe into the New York area which are carried in deep draft vessels, but no doubt might divert some business now enjoyed by the railways.

44. The construction of a 27-foot waterway might result in the diversion of some of the exports from Europe to the Quebec mills and also in the diversion of some of the exports from Newfoundland, but the navigation of the canal reaches and locks on the proposed route will still be a handicap as compared with the open route from the latter point.

45. It is estimated that 200,000 tons of newsprint per year can be considered as potential commerce for a 27-foot waterway and 100,000 tons per year as potential commerce for a 12 or 14-foot waterway.

46. *Petroleum.*—In 1935, 33 per cent of the total import tonnage of the Harbour of Montreal was crude petroleum. Petroleum is imported into Montreal in specially constructed tankers, owned and operated by the oil companies, of deeper draft than could use the suggested 27-foot waterway. The ton-mile cost of transportation by these large tankers is so low that it is impossible to see how the estimated unit savings effected by the suggested waterway would compensate for the cost of transfer at New York plus the increased cost per ton-mile of transportation by lighter draft vessel required for use even on the 27-foot waterway.

47. As far as local distribution of oil or gasoline via the suggested waterway is concerned, it must be remembered that St. Johns is the only city in Canada with a population greater than 10,000 on the waterway above Sorel. St. Johns is only 24 miles from Montreal by road as compared with 103 miles by water. When consideration is given to the cost of transshipment to and from the lighter draft tanker required and also to the fact that such transfer would have to bear the cost of the establishment of a transfer point at St. Johns or other point selected for this purpose, it is impossible to see how a deepening of the Richelieu River between St. Johns and Sorel would effect a saving in transportation costs

on present trucking costs. Trucking would still have to be resorted to to supply the territory inland from such a transfer point instead of from Montreal, or wherever the stocks are held at present.

48. It is not believed that petroleum or gasoline can be considered as potential traffic for the waterway no matter to what depth it might be constructed.

49. *Lumber.*—According to a letter from the Secretary-Manager of the Canadian Lumberman's Association, as read into the record of the public hearing on the suggested waterway held in Montreal on November 26, 1936 (page 775), the lumber industry of Eastern Canada was canvassed to obtain the views of its members as to the advisability of the suggested improvement of the existing waterway and it was found that the industry was not interested.

50. Lumber from Canada to the United States has provided from 50 to 65 per cent of the total traffic on the present Richelieu River canal system since 1915. The tonnage carried during this period has been as follows:—

Year	Tons	Year	Tons
1916	154,758	1926	64,550
1917	167,103	1927	55,644
1918	175,938	1928	48,552
1919	81,607	1929	28,398
1920	91,580	1930	15,285
1921	45,675	1931	10,639
1922	101,992	1932	2,799
1923	97,163	1933	2,642
1924	79,484	1934	1,433
1925	72,520	1935	4,360

51. The total imports into the States effected from the Province of Quebec during the last few years have been as follows:—

Importing State	1928	1930	1932	1934
New York	374,000	210,800	68,900	62,800
New Jersey	71,000	23,900	3,800	6,700
Vermont	42,000	42,900	5,700	10,400
Total	487,000	277,600	78,400	79,900

During this period, Canada furnished 90 per cent of the total foreign imports of lumber into these States. It is impossible to say how much of the above originated at points adjacent to water transportation.

52. The decrease in imports of lumber into the Eastern United States from Eastern Canada has been partly due to the completion of the Panama Canal with the consequent opening of this market to Pacific Coast lumber and also to the increase in the tariff on Canadian lumber. Further reasons for the decrease in traffic in lumber on the present waterway between the St. Lawrence River and Lake Champlain have been the depletion of the lumber producing forests in Quebec adjacent to water transportation and the present method of importing dressed lumber in carload lots rather than larger cargoes of rough lumber for dressing at the importing centre. Due to the high transshipping costs and to the damage done to dressed lumber by transshipping, only those States bordering on the waterway can be considered as offering a market for the waterborne traffic in this commodity, and also only that tonnage originating at points adjacent to water transportation can be considered as potential commerce. The transshipment costs on lumber from rail to vessel is about $1 per ton, which is too high to attract this product to the waterway, which in itself would effect a saving of only 48 cents per ton.

53. A total annual traffic of 30,000 tons of lumber from Canada to the United States is assumed as potential commerce for either a 12 or 14-foot waterway. None of this is considered as potential to a 27-foot waterway as a waterway of this depth would open up the Lake Champlain area to deep draft vessels bringing lumber from the Pacific Coast which would displace Quebec lumber.

54. The total importations of British Columbia lumber into Ontario and Quebec during the past few years have been as follows:—

Importing Province	Imports in Tons			
	1928	1930	1932	1934
Ontario	145,888	112,794	46,028	84,867
Quebec	76,427	80,612	40,087	42,403
Total	222,315	193,406	86,115	127,270

(NOTE.—Reduced from M.F.B.M. on basis of 1 M.F.B.M. =1 ton). Due to reasons previously stated, it is not believed that either a 12- or 14-foot waterway between the Hudson River and Montreal would attract any of this traffic. This is borne out by the fact that no British Columbia lumber moves by the present 12-foot waterway from Albany to Lake Ontario at Oswego.

55. A 27-foot waterway in conjunction with the St. Lawrence Deep Waterway might attract a considerable quantity of British Columbia lumber. In 1935, 10,027 tons of British Columbia lumber, as part cargo, were received by water in Montreal. The large part of the movement into Ontario is by rail. For the purpose of this analysis 150,000 tons of British Columbia lumber is assumed as potential commerce for a 27-foot waterway.

56. *Iron Ore.*—Between 1897 and 1916 there was a movement of iron ore from the United States down the Richelieu River which averaged around 20,000 tons a year with a maximum of 49,962 tons in 1915. This movement ceased entirely in 1916. This was a special ore from Port Henry destined for use in Nova Scotia mills. These mills now obtain this ore from other markets and there is no reason to believe that the deepening of the present waterway would revive this trade.

57. *Coal.*—Coal from the United States provides a ready return cargo for the vessels carrying paper to the United States via the present Richelieu River route. Most of the coal brought into Canada via this route at the present time is used by the paper manufacturing companies to supplement their importations of Nova Scotia coal.

58. There is no doubt this movement of coal from the United States would increase if the exportation of paper via the suggested waterway were to increase, unless additional subventions or reduced freight rates were granted on Nova Scotia coal. On account of the uncertainty as regards what measures might be taken by the Canadian Government to offset this increase in imports of United States coal and the fact that it is believed that any reduction in cost of transportation on the water borne movement of coal from the United States by the suggested waterway would be offset by the loss due to loss of market for Nova Scotia coal, the benefits from reduced cost of transportation of coal are not included in this analysis.

59. *Fertilizers.*—In 1934, Canada imported about 110,000 tons of fertilizers and fertilizer materials which originated at points on routes that might be expected to benefit from the suggested waterway. It has been impossible to determine to what points in Canada those materials were ultimately destined

but less than 40,000 tons were received by water at Quebec and Montreal. It is not considered that any of this can be taken as potential commerce for a 12 or 14-foot waterway due to the cost of the necessary transfer from deep draft to shallow draft vessel either at New York or Albany. It is assumed, however, that 75,000 tons per year would be potential traffic for a 27-foot waterway.

60. *Sulphur.*—Practically all of Canada's imports of sulphur originate in the United States from Gulf of Mexico ports. In 1934 the total imports into Canada amounted to about 143,000 tons. Of this total 45,000 tons were received by water at Montreal and Quebec. As in the case of fertilizers, it is not considered that any of this can be taken as potential commerce for either a 12 or 14-foot waterway but 60,000 tons per year is assumed as potential traffic for a 27-foot waterway.

61. *Hay.*—In 1903, 30,494 tons of hay were carried on the Chambly Canal from Canada to the United States. This movement has gradually fallen off until in 1935 only 890 tons were reported. According to the Annual Report of Foreign Commerce and Navigation of the United States for 1934, Canada supplied 98·5 per cent of the total imports of hay into the United States during that year, the only other source being Mexico. The decrease in traffic of hay on the canal is no doubt due to the increase in use of motor cars and is paralleled by the decrease in total imports of hay into Vermont, which have decreased from 120,000 tons in 1914 to about 10,000 tons in 1934.

62. An annual potential traffic in hay on the suggested waterway of either 12, 14, or 27-foot depth, of 5,000 tons, is assumed in this analysis.

63. *Sand and Stone.*—The traffic in sand and stone on the Chambly Canal from the United States to Canada has decreased from about 20,000 tons in 1913 to 2,800 tons in 1935. It may be presumed that this decrease is due to the decrease in tonnage of all commodities from Canada to the United States, as sand and stone provided a ready return cargo. As a maximum, 3,000 tons of sand and stone might be taken as potential commerce for the suggested waterway.

64. *Miscellaneous.*—Canadian Industries, Ltd., who have a plant at Beloeil on the Richelieu River, submitted a brief to the International Joint Commission setting out the tonnage now handled by barge from steamer at Sorel to Beloeil. The commodities and approximate tonnage thereof handled at the present time was stated to be as follows:—

Nitrate of soda, in bulk	4,000 tons from Hopewell, Va.
Sulphur	1,100 tons from Texas
Muriate of Potash	2,500 tons from Europe
Phosphate rock	18,000 tons from Florida
Total	25,600 tons

65. At the present time, a depth of 12 feet is available from Sorel to about St. Ours and the existing project of Canada contemplates the deepening of the existing channel to 12 feet up to Beloeil. Therefore, the improvement of the through route between Lake Champlain and Sorel to 12 feet would only mean that this company could tranship from deep draft vessel to barge at Albany instead of at Sorel. Although this would decrease the sailing distance of the deep draft vessel it would increase the sailing distance of the barge and would of course transfer the transhipping business from Sorel to Albany.

66. *General Merchandise.*—The maximum southbound movement of general merchandise on the Chambly Canal from Canada to the United States was in 1929 when about 31,000 tons were carried. The maximum northbound movement from the United States to Canada was about 17,000 tons in 1920. In

1935 only 352 tons of miscellaneous merchandise was carried on the Chambly Canal between the two countries. This decrease is due no doubt to change in methods of merchandising and to the advent of truck transportation.

67. For the purpose of this analysis, a total maximum annual tonnage of miscellaneous products that might be considered as potential commerce for either a 12 or 14-foot waterway is taken at 30,000 tons. As far as a 27-foot waterway is concerned, the tonnage in miscellaneous products might be considerably greater than the above and for the purpose of this analysis a total of 80,000 tons a year is taken as potential to the 27-foot waterway.

68. *Summary.*—The total potential Canadian commerce for the suggested waterway of various depths is summarized as follows:—

Commodity	Potential Canadian Commerce in Tons		
	27-ft. waterway	14-ft. waterway	12-ft. waterway
Sugar and molasses	125,000	.....	.....
Cocoa beans and coffee	8,000	.....	.....
Newsprint paper	200,000	100,000	100,000
Lumber—British Columbia to Quebec and Ontario	150,000	.....	.....
Quebec to U.S.	.....	30,000	30,000
Fertilizers	75,000	.....	.....
Sulphur	60,000	.....	.....
Hay	5,000	5,000	5,000
Sand and stone	3,000	3,000	3,000
Miscellaneous products	80,000	30,000	30,000
Total annual potential Canadian commerce—Tons	706,000	168,000	168,000

POTENTIAL UNITED STATES COMMERCE

(Excluding commerce between the United States and Canada)

69. In the preparation of foreign trade estimates, considerable attention has been centered on Senate Document No. 116, 73d Congress, 2d session, a "Survey of the Great Lakes-St. Lawrence Seaway and Power Project," a United States Interdepartmental report, in which the War Department made detailed estimates of the traffic potentialities of the St. Lawrence Waterway. The analysis of foreign trade therein was based on the import and export trade of 1929. The foreign trade of the United States decreased nearly 50 per cent from 1929 to 1932. Estimates herein are based on tonnage figures for the years 1934 and 1935.

70. In estimating the potential foreign commerce that could profitably utilize the improved St. Lawrence Waterway, the interdepartmental report selected for study a list of commodities important from the standpoint of consumption and production in the tributary area. The list of twenty-one import and twenty export items follows:

IMPORTS

Hides and skins
Bananas
Nuts
Vegetable oils and oil seeds
Cocoa and cacao
Coffee
Tea
Spices
Sugar
Rubber and substitutes
Dyeing and tanning materials
Cabinet woods
Wood pulp
Rags and other paper stock
Clay
Asphalt
Chalk
Pyrites
Magnesite
Manganese and ferro-manganese
Tin

54520—10½

EXPORTS

Meats
Animal fats
Grain
Flour and meal
Hominy and grits
Cereal foods
Linseed oil cake and meal
Feed
Starch, glucose and corn sugar
Paper
Iron and steel, bars and rods
Iron and steel, plates and shapes
All other crude manufactures of iron and steel
Copper, ingots and bars
Copper, rolled forms and wire
Agricultural implements
Autos and parts
Chemicals, excluding sulphate of ammonia, phosphates, and other fertilizer materials
Sulphate of ammonia
Soap

71. For imported items such as sugar and coffee, having general consumption, estimates were prepared on a per capita basis for the population within the area considered tributary to the waterway. For imported materials used by industries, such as wood pulp, china clay, rubber, etc., estimates were based on the requirements of the industries located within the tributary area. The amount of potential export tonnage was estimated as the proportion that the production in the tributary area bore to the total production of the United States. Final estimates were reduced by one-third to compensate for the closed season of navigation. Import and export trade statistics were based on the year 1929 and excluded trade with Canada.

72. In estimating possible tonnage for foreign trade movements by way of the proposed Lake Champlain waterway, the method explained in the preceding paragraph was adopted. Estimates are based on the foreign trade of 1934 and 1935. It is assumed that the duration of the closed season on the proposed Lake Champlain route would be substantially the same as on the improved St. Lawrence waterway.

73. The list of import commodities considered in connection with the proposed Lake Champlain waterway excludes wood pulp, clay, chalk, and pyrites for the reason that these items originate in markets from which voyage time via the St. Lawrence is shorter. In respect to exports, grain, for reasons stated below, is stricken from the list.

74. Grain, especially wheat, has always been considered one of the major commodities in connection with studies of proposed deep waterways between the Great Lakes and the Atlantic. During the past few years, however, such factors as foreign tariffs, quota establishments, droughts, and domestic agricultural legislation make the future importance of domestic wheat as an export item in the international trade of this country difficult to appraise. A review of the subject reveals that in 1920-1921 exports of domestic wheat reached a high mark of 373 million bushels. During the ten years 1919-1929, exports were never less than 162 million bushels annually, except in 1925, when a short crop caused the exportable surplus to be cut into for domestic use. The average for the ten years was about 225 million bushels. During the last ten years, notably between 1928 and 1931, Germany, France, Italy, and Great Britain, all of them among this country's former best customers, have raised their duties on the importation of wheat. These tariff increases have, in a number of cases, stimulated production to such an extent that their needs are largely supplied from domestic sources. From July, 1933, to March, 1934, only 18¾ million bushels of wheat were exported from the United States. Almost 16¾ million bushels or about 503,000 tons moved into export through the Washington-Oregon customs area. While data are not at hand by which to show the exact portion of the 16¾ million bushels that moved to the Orient, it is a matter of record that 8⅓

million bushels were shipped to China under an agreement between the Reconstruction Finance Corporation and the Chinese Government during the 1933-1934 period stated above.

75. In reference to all grains, wheat, corn, oats, rye, and barley, data secured at the offices of the New York Produce Exchange show the amounts, segregated as to Canadian and American origin, exported from the ports along the St. Lawrence-Atlantic coastal rim from Montreal to Norfolk, Virginia, during the period 1932-1935. These data have been consolidated and are presented in Table I, Appendix B. Exports of United States wheat from United States Atlantic ports decreased from almost 29 million bushels in 1932 to less than one and one-half million bushels in 1933 and to zero in 1934 and 1935. During the same period, exports of United States wheat through Canadian Atlantic ports decreased from 6 million bushels in 1932 to less than 2 million bushels in 1933, then to about one-quarter of a million in 1934 and to zero in 1935. Exports of Canadian wheat from United States Atlantic ports remained fairly constant during the first three years of the period, but declined from about 31 million in 1934 to approximately 20½ million bushels in 1935. Inasmuch as recent subsidies in favor of grain moving in British ships bid fair to eliminate this traffic, the movement of grain is not considered in studying possible export tonnage for the proposed Lake Champlain waterway.

76. Table II, Appendix B, shows imports during 1934 of selected commodities from certain world trade regions, also the portion of these and other commodities estimated as available for movement via the proposed waterway under study. Exports to the assumed markets, together with the amounts estimated as potential tonnage, are shown in Table III, Appendix B. After deductions have been made for the closed season of navigation, the estimated total amount of possible imports is 2,788,000 tons and exports 819,000 tons, making a total of 3,607,000 tons of potential foreign traffic for the proposed Lake Champlain waterway.

TABLE I.

EXPORTS OF WHEAT AND OTHER GRAINS FROM CANADIAN AND UNITED STATES ATLANTIC PORTS, 1932–1935

(Quantities expressed in thousands of bushels)

Year	Ports*	Wheat		Corn	Oats		Rye		Barley	
		United States	Canadian	United States	United States	Canadian	United States	Canadian	United States	Canadian
1932	Canadian Atlantic ports	6,174	95,148	2,025	415	7,261	1,062	8,479	491	9,756
	United States Atlantic ports	28,796	31,153	1,909	46	93	41	514	.....	129
	Total	34,970	126,301	3,934	461	7,354	1,103	8,993	491	9,885
1933	Canadian Atlantic ports	1,712	84,792	54	.....	1,030	.....	180	.....	753
	United States Atlantic ports	1,397	25,253	395	25	.....	.....	355	.....	.....
	Total	3,109	110,045	449	25	1,030	.....	535	.....	753
1934	Canadian Atlantic ports	295	58,316	96	.....	2,997	.....	115	.....	2,988
	United States Atlantic ports	.....	30,880	221	5	.....	.....	.....	.....	.....
	Total	295	89,196	317	5	2,997	.....	115	.....	2,988
1935	Canadian Atlantic ports	.....	46,382	.....	.....	8,345	.....	656	.....	4,945
	United States Atlantic ports	.....	20,659	17	26	133	.....	21	.....	33
	Total	.....	67,041	17	26	8,478	.....	677	.....	4,978

SOURCE: New York Produce Exchange.

* Canadian Atlantic ports: Montreal, Sorel, Quebec, Halifax, West Saint John, and Saint John.
United States Atlantic ports: Portland, Boston, New York, Albany, Philadelphia, Baltimore, Newport News, and Norfolk.

TABLE II.

IMPORTS OF SELECTED COMMODITIES DURING 1934 BY TRADE REGIONS, AND AMOUNTS ESTIMATED AS AVAILABLE FOR MOVEMENT VIA PROPOSED LAKE CHAMPLAIN WATERWAY

(Quantities expressed in tons)

—	Central America and Mexico	West Indies	South America: north and west coasts and one-half east coast	India and East Indies one-half	Orient	Oceania	Africa one-half	Total imports selected commodities from areas named Column A	Per cent imports estimated consumed in tributary territory Column B	Estimated as available for movement Column C
Coffee	48,523	977	428,999	13,870	.....	.....	6,243	498,612	38·2	190,470
Sugar	.....	1,829,904	4,651	297,713	205	.....	.....	2,132,473	35·1	748,498
Rubber and substitutes	466	.....	2,955	260,673	.....	.....	.....	264,094	63·3	167,172
Bananas	944,166	161,184	85,964	.....	.....	.....	.....	1,191,314	38·2	455,082
Hides and skins	2,801	700	19,386	6,213	5,166	8,066	3,131	45,463	22·7	10,320
Vegetable oils and oil seeds	10	2	2,569	213,486	101,750	3,020	17,097	337,934	33·6	113,546
Cocoa and cacao beans and shells	6,948	32,644	47,527	159	449	417	48,207	136,351	32·5	44,314
Tea	.....	.....	.....	5,055	14,562	.....	.....	19,617	34·6	6,787
Spices	5	1,864	54	9,918	3,143	19	1,828	16,831	37·4	6,295
Dyeing and tanning materials	39	160	31,567	5,392	1,153	2	3,707	42,020	25·0	10,505
Cabinet woods	5,771	603	1,676	747	18	1,156	1,256	11,227	49·4	5,546
Rags and other paper stock	13	331	454	40	19,928	.....	1,662	22,428	30·5	6,841
Asphalt	.....	15,484	.....	.....	.....	.....	.....	15,484	50·0	7,742
Magnesite	.....	.....	.....	289	.....	.....	.....	289	67·5	195
Manganese and ferro-manganese	.....	71,391	32,540	11,508	.....	.....	41,275	156,714	58·8	92,148
Tin	1	.....	.....	14,868	3,196	54	155	18,274	59·9	10,946
Total	1,008,743	2,115,244	658,342	839,931	149,570	12,734	124,561	4,908,125	.....	1,876,407

SOURCE: U.S. Department of Commerce, "Foreign Commerce and Navigation of the United States". Data converted into short tons.

SUMMARY

Portion of selected commodities estimated as available for movement via waterway (total Column C)	1,876,407	tons
Total all other commodities estimated as available for movement via waterway	2,305,593	"
Total all commodities estimated as available for movement via waterway	4,182,000	
To compensate for closed navigation season (deduct 33·3 per cent)	1,394,000	"
Net total tonnage estimated as available for waterway	2,788,000	"

TABLE III.

EXPORTS OF SELECTED COMMODITIES DURING 1934 BY TRADE REGIONS, AND AMOUNTS ESTIMATED AS AVAILABLE FOR MOVEMENT VIA PROPOSED LAKE CHAMPLAIN WATERWAY

(Quantities expressed in tons)

—	Central America and Mexico	West Indies	South America north and west coasts and one-half east coast	India and East Indies one-half	Orient	Oceania	Africa one-half	Total exports selected commodities to areas named Column A	Per cent exports estimated originating in tributary territory Column B	Estimated as available for movement Column C
Meat products	5,217	13,247	1,414	924	133	730	562	22,867	70·0	15,559
Animal oil and fats	23,226	18,733	4,915	42	237	12	219	47,384	60·4	28,620
Flour	50,600	125,700	35,950	24,300	56,400	3,000	16,100	312,050	61·5	191,911
Iron and steel (bars and rods)	5,568	2,988	12,213	3,291	24,503	192	208	48,963	62·6	30,651
Iron and steel (plates, sheets, skelp, strips, and non-fabricated shapes)	50,194	18,840	69,299	27,353	99,277	4,812	11,768	281,543	62·8	176,809
Copper (ingots, bars, etc.)	1,365	15	937	326	61,907	.....	157	64,707	18·0	11,647
Copper (rolled forms and wire)	2,097	700	2,403	3,077	639	305	19	9,240	18·0	1,663
Automobiles (passenger cars, motor trucks, busses and chassis, and parts for assembly)	13,175	6,449	32,814	12,750	20,493	7,628	5,554	98,863	78·5	77,607
Agricultural implements	4,022	5,892	9,883	1,526	1,754	12,476	7,318	42,871	87·8	37,640
Hominy and grits	43	1,090	.....	.....	.....	.....	.....	1,133	70·0	793
Cereal foods	2,774	1,829	1,396	416	525	5	334	7,279	70·0	5,095
Linseed oil cake and oil meal	84	10,303	213	3	.....	2	.....	10,605	60·0	6,363
Feed	2,181	2,948	258	199	251	2	11	5,850	70·0	4,095
Starch, glucose and corn sugar	518	1,261	433	6,003	1,009	1,107	827	11,158	75·0	8,369
Paper	3,892	30,093	8,713	39,068	51,680	5,762	1,633	140,841	42·0	59,153
Sulphate of ammonia	19	10,731	511	4,728	1,099	.....	693	17,781	60·0	10,668
Soap	2,043	2,786	683	1,072	1,580	15	220	8,399	36·0	3,024
Total	167,018	253,605	182,035	125,078	321,487	36,048	45,623	1,130,894	.....	669,667

Source: U. S. Dept. of Commerce, "Foreign Commerce and Navigation of the United States". Data converted into short tons.

SUMMARY

Portion of selected commodities estimated as available for movement via waterway (total Column C)	669,667	tons
Total all other commodities estimated as available for movement via waterway	559,333	"
Total all commodities estimated as available for movement via waterway	1,229,000	"
To compensate for closed navigation season (deduct 33·3 per cent)	410,000	"
Net total tonnage estimated as available for waterway	819,000	"

POTENTIAL DOMESTIC COMMERCE OF THE UNITED STATES

77. GENERAL.—In the following analysis of domestic traffic possibilities, estimates are based on the assumption that all freight shipments in deep draft vessels to and from the Great Lakes ports and those on the Atlantic seaboard will move by way of the proposed Lake Champlain Waterway. It is probable, however, that certain traffic, for one reason or another, would move by way of the proposed St. Lawrence Waterway, even though the Lake Champlain route offers a much shorter route to the coast. In considering domestic traffic, a study of each of the more important items of bulk freight will be presented first, followed by estimates of the amount of package freight business that might be drawn to the proposed waterway. Such bulk freight items as ore, coal, and oil have sources and destinations that are easily determined and the routes by which they move can be readily studied. On the other hand, the general package-freight traffic is of a very different character. This trade is made up of hundreds of different commodities, each having its own origin, route, and destination, and many individual peculiarities as to rates, methods of handling, and other details.

78. BULK FREIGHT—*Iron Ore.*—This commodity is the greatest in tonnage being transported on the Great Lakes. Large deposits also abound in the region of Lake Champlain and, as there is large manufacture of iron and steel products along the eastern seaboard, it is possible that iron ore would move over the proposed Lake Champalin route from those deposits. At present, iron ore moves downbound from Lake Superior to lower Lake Michigan ports and to Lake Erie ports. The major portion of this tonnage is received at Lake Erie ports, according to Table IV, Appendix B, and is smelted principally at cities located within a short rail haul of Lake Erie, such as the Pittsburgh, Johnstown, or Youngstown districts. A small percentage of the ore receipts at Lake Erie ports is forwarded, chiefly by rail, to the east, as shown in Table V, Appendix B. There are steel plants at Bethlehem, Pennsylvania; another at Sparrow Point, Maryland, near Baltimore; and a small plant at Troy, New York. The latter two could be reached via the proposed waterway. The Bethlehem and Sparrow Point plants normally use some Lake Superior ore but use much greater quantities of Cuban and Chilean ores which they import in their own vessels. Imports of iron ore at Baltimore are shown in Table VI, Appendix B.

79. In order to divert to the proposed waterway the present rail movement of Lake Superior ore to eastern Pennsylvania, the water rate would have to be lower than the rail rate. Using shipments to Bethlehem as an example, the existing lake-rail rate is $2.72 per ton. The rail rate to Bethlehem from New York is 90½ cents per ton, exclusive of loading. The water rate from Duluth to New York by way of the Lake Champlain route is estimated at $1.75. Adding a loading charge of eight cents and 90½ cents for the rail haul gives a total lake-canal-rail rate of $2.73. This is one cent in excess of the existing rate. It is possible that the proposed waterway would attract some of the ore traffic to eastern Pennsylvania furnaces but the savings would be negligible.

80. It is difficult to estimate to what extent imported ores used at Sparrow Point might be displaced by those of the Lake Superior region. A certain percentage of foreign ore is used for blending purposes and other ore is imported because it is cheaper, especially when hauled by industrial carriers. It is doubtful if the proposed waterway would offer enough saving that any of the foreign ores would be displaced by domestic ores unless a large scale development of the Adirondack ore fields resulted from its construction.

81. In respect to a movement to Troy, the existing lake-rail rate from Lake Superior is $2.12 per ton. The estimated rate by way of the proposed waterway, including loading charge of eight cents, is $1.43, a difference of sixty-nine cents per ton. It should be remembered, however, that in the area adjacent to the Lake Champlain route is the source of the Troy plant's present supply. In view of the intermittent operation of this plant it is difficult to state what result a possible sixty-nine-cent reduction in the cost of securing Lake Superior ore or the possibility of obtaining large unit cargoes of Adirondack ore might have.

82. Construction of the proposed waterway would offer the opportunity for Adirondack ore, which is of a high grade, to move into the Great Lakes and to the Atlantic seaboard. It is possible that a substantial movement to the Atlantic seaboard might develop in view of the present barge movement from Port Henry, on Lake Champlain, to New York Harbor for transfer to Sparrow Point. Such a development, however, is so indefinite that no estimate of the amount of such movement can be made.

83. *Coal.*—This commodity is the second largest item of freight handled on the Great Lakes and large quantities are consumed in the area directly tributary to the eastern section of the proposed waterway. Production of bituminous coal is spread over twenty-four states, six of which account for more than eighty per cent of the total mined. According to Table VII, Appendix B, these six states produced 302 million tons in 1934. The great bulk of the coal moved on the Great Lakes is mined in these states from where it moves by rail principally to Lake Erie ports to be loaded. New England's as well as New York's supplies are drawn chiefly from West Virginia and western Pennsylvania, about half of which moves by rail to Philadelphia, Baltimore, and Hampton Roads, and thence by water to New York and New England points. In estimating the possible movement of coal via the proposed deep waterway, no appraisal has been made of the effect of the development of electric energy in the International Rapids section of the St. Lawrence on the present demand for coal in New York and New England.

84. In respect to a possible movement from western Pennsylvania to Albany and New York City by way of the proposed waterway, the rail rate from those fields to Cleveland, for example, averages $1.60 per ton. It is estimated that the rate on soft coal from Lake Erie to Albany and New York by way of the proposed waterway would be $1.27 and $1.53 respectively. This gives a total rail-canal rate via Cleveland to New York of $3.13. The all-rail rate from western Pennsylvania fields to New York is $3.22. This is nine cents in excess of the possible waterway rate. In view of the other competitive rail-water rate, that is, via Baltimore or Norfolk, it is questionable whether any substantial tonnage might be expected. The all-rail rate from western Pennsylvania fields to Albany is the same as to New York, $3.22 per ton. The rail-waterway rate is estimated to be $2.87 while the rail-ocean-river rate for West Virginia coal via Baltimore, it is estimated, would be about $3.25. It would appear, therefore, that a movement of soft coal to Albany might be expected to be attracted to the proposed waterway. The exact receipts in the Albany area are not known but it is thought that annual amounts are between four and five million tons, much of which moves on into western New England. Inasmuch as coal traffic is seasonal, being heaviest in the winter months when the waterway would be closed, it is not possible that the proposed route would deprive the rails of more than half of this traffic.

85. Another movement that appears likely is that from Lake Erie into Lake Champlain, to Burlington or Plattsburg, for example. It is estimated that

a rail-water rate of $2.79 per ton might be possible to these ports from western Pennsylvania fields via Cleveland. In the absence of the existing all-rail rate from these fields to Burlington, the rate to Albany, $3.22 per ton is assumed, indicating a saving of about forty-five cents per ton. It is believed that this figure is a very reasonable estimate in view of the possibility of securing return loads of ore, as pointed out in a previous paragraph. As in the case of Albany, the exact soft coal requirements of Vermont are not known. In a recent year the industries of Vermont consumed slightly over 300,000 tons.

86. Computed in a similar manner, the prospective rate via Cleveland to Boston would be considerably less than the all-rail rate from western Pennsylvania fields to Boston, but the movement would be closely competitive with the rate by way of rail-water out of Norfolk or Baltimore. It is doubtful if the spread between the rates would be sufficient to attract coal traffic for Boston to the proposed waterway.

87. *Oil, crude and refined.*—On the Great Lakes, the major portion of this trade is in gasoline and kerosene shipped in bulk from Indiana Harbor where it is received by pipe line. In 1934, slightly more than 1,500,000 tons of refined products were shipped out. Much of it moved into Lake Superior, the ports of Duluth-Superior received about 440,000 tons. There is a movement from refineries at Sarnia, Ontario, eastward through Lake Erie and the Welland Ship Canal to Canadian ports on Lake Ontario and the St. Lawrence River; there is also a westward movement from refineries in Quebec and eastern Ontario. In 1934, 390,000 tons, about half of which was gasoline, moved eastward through the Welland Ship Canal, while 328,000 tons, chiefly gasoline, moved westward.

88. The movement of petroleum products through the New York State Barge Canal system during the past seven seasons is shown in Table IX, Appendix B. This traffic has increased sharply since 1929. The tonnage of 1935 accounted for forty per cent of the total amount of freight moved through the canal system. The bulk of the movement, eighty-nine per cent or 1,513,000 tons in 1934, moved by way of the Erie division. Little, if any, of this traffic could be expected to be drawn to the proposed Lake Champlain route because at Waterford, 2·5 miles above Troy, the Erie division and the Champlain division part at almost right angles. However, the trend in the movement of this commodity through the Champlain division of the canal has been steadily upward during the past six seasons, increasing from 34,000 tons in 1930 to 145,000 tons in 1935, to Lake Champlain ports alone. The potential movement of petroleum products over the proposed waterway is estimated at 300,000 tons.

89. *Lumber.*—The area lying adjacent to the Great Lakes relies briefly upon other sections of the country for its higher-grade lumber needs. Yellow pine moves into the Lakes region from Gulf of Mexico ports by rail at the rate of 45½ cents per hundred to Buffalo and at slightly lower rates to Cleveland and Chicago, while the coastwise rate to New York from the Gulf is about forty-two cents per hundred. It is apparent, therefore, that shipments from Pacific coast ports to ports on Lake Champlain and on the Great Lakes would be the only lumber to be attracted to the Lake Champlain waterway. Several of the vessels now engaging in the lumber trade between the north Pacific and Albany are of sizes that would permit them to operate in this service through a waterway twenty-seven feet in depth. The normal receipts of lumber in the Great Lakes area from outside sources are estimated to be between three and four million tons. However, during the past few years a much lesser figure has supplied the needs, as indicated by the sharp decline in construction contracts, freight-car loadings of forest products, and factory employment in sawmills. The potential lumber tonnage estimated for the proposed waterway is 900,000 annually.

90. *Sulphur.*—This bulk commodity is one of the large tonnage items being transported westward on the New York State Barge Canal for consumption in the Great Lakes region. In 1935 this movement amounted to 182,491 tons, as shown in Table IX, Appendix B. It is probable that the proposed deep waterway would attract most of the sulphur traffic for the Great Lakes area. A potential tonnage of 300,000 is estimated for movement.

91. PACKAGE FREIGHT.—This class of freight on the Great Lakes is composed of a wide variety of articles and is of small tonnage compared with the movements of bulk freight. Leading items of package-freight traffic are automobiles, copper, flour and feed, pig and manufactured iron and steel, sugar, and general merchandise. The estimates herein assumed that shippers might be willing to so rearrange their system of distribution as to use one means of transportation, say five months, and another for seven months of the year.

92. *Automobiles and Parts.*—Approximately eighty per cent of the automobile production of this country is concentrated in the area adjacent to the Great Lakes. Based on the total registrations of 26,221,000 vehicles in 1935, about thirty per cent, including trucks, are located in the area tributary to the eastern end of the proposed waterway and thirty-one per cent of total registration is divided among those States having ocean ports on the Atlantic, Gulf, and Pacific coasts. In respect to passenger cars alone, over 3,000,000 new vehicles were registered in the United States in 1935. Of this total, about 780,000 registrations were in the States located in the eastern area of the proposed Lake Champlain route. In addition, approximately 795,000 were registered in those States having ocean outlets along the Atlantic-Gulf-Pacific coastal rim.

93. The transportation of automobiles and trucks has risen to a place of importance in the Lakes trade during the past ten years. One company has equipped twelve vessels which engage almost exclusively in carrying motor vehicles. One of the boats, a converted ore ship, can carry 400 units per trip between Detroit and Cleveland. In 1935, shipments out of Detroit by lake amounted to 342,820 tons; from Buffalo, 14,291 tons; and from Cleveland, 8,781 tons; a total of 365,892 tons which closely approximates 280,000 vehicles, considering the average weight to be 1·3 tons per car. Receipts at these ports during the same season were 15,865 tons, 192,617 tons, and 124,531 tons, respectively. At Lake Michigan ports, shipments from Muskegon amounted to 35,869 tons; and from Milwaukee, 3,793 tons. Receipts of automobiles at these ports were 4,916 tons, and 53,062 tons respectively.

94. Based on data published by the Automobile Manufacturers Association, approximately 500,000 vehicles is a reasonable estimate of the number shipped from the Great Lakes region to the area tributary to the eastern end of the proposed Lake Champlain waterway. It is estimated that one-third of this figure might move by way of the proposed water route, giving a potential traffic of 170,000 vehicles or about 225,000 tons.

95. *Sugar.*—The movement of this commodity on the Great Lakes is chiefly westward from Buffalo and Erie. In recent years refined sugar has become one of the leading items of interstate tonnage moving through the New York State Barge Canal. (See Table IX, Appendix B.) The traffic originates at the Atlantic coast refineries with destinations being principally Buffalo, Chicago, Detroit, Toledo, and Cleveland, in that order in 1934. The entire sugar tonnage that might move on the proposed waterway, however, was included under the estimate of import tonnage in Table II, Appendix B.

96. *Flour and Feed.*—Eastbound shipments of domestic flour through the Soo averaged about 326,000 tons during the five-year period from 1930 to 1934. Shipments out of Chicago area by lake averaged 118,000 tons. Likewise receipts at Detroit averaged 3,000 tons, at Buffalo 406,000 tons, and at Erie 38,000 tons. It will be seen that total receipts at the lower ports check rather closely with total shipments through the Soo and from Chicago.

97. Statistical data do not show separately the shipments of flour and feed from Milwaukee; the average of the two combined has been 320,000 tons during the five-year period stated above. Shipments of feed out of the Chicago area by lake averaged 53,000 tons. At Buffalo and Erie differentiation between feed and other mill products is now shown in all years. Receipts at these two ports closely approximate the shipments from Milwaukee and Chicago. A total interlake movement of approximately one million tons is thus indicated.

98. The excess of consumption over production in the region bordering on the eastern section of the proposed deep waterway is estimated to be roughly 2,000,000 tons annually, of which about 1,400,000 tons may be assumed to move during the season of navigation. In view of the adaptability of this type of tonnage for water transportation, it is estimated that a movement of around 1,000,000 tons might be considered potential for the proposed deep waterway.

99. *Copper.*—In a recent year approximately 171,000 tons of copper were produced in Montana and Michigan. The eastbound movement of domestic copper through Saint Marys River has averaged 33,000 tons during the six-year period 1929-1934. Average receipts at Buffalo and Erie have been approximately 13,000 tons, which figure, it is believed, closely indicates the extent of present lake-rail movement. It is estimated that one-half the copper produced in Montana and Michigan moves into the area tributary to the eastern end of the proposed waterway and that 50,000 tons might be expected to move during the open season. An export movement to certain markets is indicated in Table III, Appendix B.

100. *Iron and steel.*—The movement in all directions on the Great Lakes of iron and steel in unmanufactured forms and in rolled forms, during the period 1929-1934, averaged 865,000 tons, with the former averaging 1,166,000 tons and the latter, 565,000 tons. On the New York State Barge Canal, the average tonnage of pig iron and billets, during the period 1930-1934, was 61,000 tons, and other iron and steel articles, 116,000 tons. In view of the consumption of iron and steel along the seaboard during recent years, a potential movement of about 225,000 tons, including production of pig at Port Henry and Troy, is assumed.

101. *Meat and Dairy Products.*—The major portion of these commodities for eastern consumption and export originate in the Great Lakes area. In respect to dairy products alone the eastward movement on the Great Lakes is impressive. In 1921, almost 20 million pounds or 10,000 tons moved from Duluth eastward by water; in 1931, the eastward traffic amounted to 138 million pounds or 69,000 tons, and in 1934, about 50,000 tons. Special equipment is required for the handling of meat and dairy products and it is possible that a substantial through trade, in refrigerator ships, might be developed by way of the proposed deep waterway. Exports to tributary foreign markets are shown in Table III, Appendix B. Possible domestic movements are included in the following estimate of general merchandise.

102. *General Merchandise.*—While the combined total of the specific commodities treated in the preceding paragraphs would account for the greater

portion of potential package freight tonnage, as it does of the present lake-rail movement, there would, no doubt, be a considerable amount of general merchandise or miscellaneous package freight drawn to the proposed waterway. It is believed reasonable to assume that the items mentioned in the preceding paragraphs would account for about three-quarters of the total movement, with the potential movement of general merchandise being one-quarter or approximately 500,000 tons.

103. *Total United States Domestic Commerce.*—The total of United States domestic traffic estimated as potential for movement on the proposed Lake Champlain Waterway is as follows:

Bulk freight—	
Coal	2,000,000 tons
Oil	300,000 "
Lumber	900,000 "
Sulphur	300,000 "
Package freight—	
Automobiles	225,000 "
Flour and feed	1,000,000 "
Copper	50,000 "
Pig and manufactured iron	225,000 "
General merchandise	500,000 "
Total	5,500,000 "

TABLE IV

SHIPMENTS OF IRON ORE ON THE GREAT LAKES

(Quantities expressed in tons)

Year	Eastbound through Sault Ste. Marie	Received at Lake Michigan ports	Received at Lake Erie ports
1928	53,225,102	15,974,693	41,786,497
1929	64,827,025	18,608,684	48,910,257
1930	46,990,351	14,051,944	36,743,627
1931	24,221,819	8,062,217	17,485,238
1932	3,559,183	641,760	3,170,944
1933	22,226,025	4,944,236	18,814,806
1934	22,945,299	5,742,381	18,270,591
1935	29,283,106	7,204,024	23,415,421

SOURCE: Annual Reports, Chief of Engineers, Part 2.

TABLE V

RECEIPTS OF IRON ORE BY RAIL AT CERTAIN EASTERN POINTS FROM LAKE ERIE PORTS

(Quantities expressed in tons)

Year	To eastern Pennsylvania and Maryland (1)
	tons
1930	196,151
1931	17,652
1932	4,465
1933	5,025
1934	2,731

SOURCE: The Lake Superior Iron Ore Association, Cleveland, Ohio.
(1) Principally Steelton, Bethlehem, and Philadelphia, Pennsylvania, and Sparrow Point, Maryland. No shipments moved to Troy, N.Y. during this five-year period.

TABLE VI

IMPORTS OF IRON ORE AT BALTIMORE, MARYLAND

(Quantities expressed in tons)

Year	Amount
1929	2,366,446
1930	2,120,446
1931	992,690
1932	565,566
1933	780,454
1934	1,136,550
1935	1,225,986

SOURCE: Annual Reports, Chief of Engineers, Volume 2.

TABLE VII.

PRODUCTION OF BITUMINOUS COAL BY LEADING STATES, 1926-1934

(Quantities expressed in millions of tons)

State	Average 1926-1930	1930	1931	1932	1933	1934
Illinois	57	54	44	33	37	41
Indiana	18	16	14	13	14	15
Ohio	21	23	20	14	20	21
Pennsylvania	137	124	98	75	79	89
West Virginia	136	121	101	86	94	98
Kentucky	61	51	40	35	31	38
Total 6 States	430	389	317	256	275	302
Total U.S.	519	468	382	310	334	358
Percentage 6 States of Total U.S.	83	83	83	83	82	84

TABLE VIII

MOVEMENT OF COAL ON THE GREAT LAKES

(Quantities expressed in tons)

Year	Bituminous	Anthracite	Total
1924	22,941,974	2,918,541	25,860,515
1929	37,933,249	1,321,328	39,254,577
1930	36,839,923	1,232,137	38,072,060
1931	30,415,291	761,068	31,176,359
1932	24,563,391	293,978	24,857,369
1933	31,351,353	425,301	31,776,654

SOURCE: Annual Report, Lake Carriers' Association.

TABLE IX

MOVEMENT OF PETROLEUM PRODUCTS, SULPHUR, AND SUGAR ON NEW YORK STATE BARGE CANAL SYSTEM, 1929-1935

(Quantities expressed in tons)

Year	Petroleum products	Sulphur	Sugar
1929	474,482	226,859	160,453
1930	737,484	206,345	128,290
1931	889,476	125,378	303,973
1932	983,036	78,597	401,997
1933	1,365,338	198,110	406,273
1934	1,698,731	178,782	199,540
1935	1,805,797	182,491	195,036

SOURCE: Annual Reports, Superintendent, Department of Public Works, State of New York.

II

ST. LAWRENCE WATERWAY

On January 21, 1920, the Government of the United States, with the concurrence of the Canadian Government, referred to the International Joint Commission for investigation and report, under the terms of Article IX of the Treaty of January 11, 1909, certain questions relating to the improvement of the St. Lawrence River between Lake Ontario and Montreal for navigation and power.

These questions are as follows:—

"Question I.—What further improvement in the St. Lawrence River, between Montreal and Lake Ontario, is necessary to make the same navigable for deep-draft vessels of either the lake or ocean-going type; what draft of water is recommended; and what is the estimated cost?

In answering this question the Commission is requested to consider:—

(*a*) Navigation interests alone, whether by the construction of locks and dams in the river; by side canals with the necessary locks; or by a combination of the two.

(*b*) The combination of navigation and power interests to obtain the greatest beneficial use of the waters of the river.

Question II.—Which of the schemes submitted by the Government or other engineers is preferred, and why?

Question III.—Under what general method of procedure and in what general order shall the various physical and administrative features of the improvement be carried out?

Question IV.—Upon what basis shall the capital cost of the completed improvement be apportioned to each country?

Question V.—Upon what basis shall the costs of operation and maintenance be apportioned to each country?

Question VI.—What method of control is recommended for the operation of the improved waterway to secure its most beneficial use?

Question VII.—Will regulating Lake Ontario increase the low-water flow in the St. Lawrence Ship Channel below Montreal? And if so, to what extent and at what additional cost?

Question VIII.—To what extent will the improvement develop the resources, commerce, and industry of each country?

Question IX.—What traffic, both incoming and outgoing, in kind and quantity, is likely to be carried upon the proposed route, both at its inception and in the future, consideration to be given not only to present conditions, but to probable changes therein resulting from the development of industrial activities due to availability of large quantities of hydraulic power?"

In interpreting the reference, the Commission found it necessary to take into consideration the whole system of waterways from the head of the Great Lakes to the sea.

Because of its close relationship to the subject-matter of the Champlain Report, it was considered desirable to include in this Appendix a summary of the results of the investigations in connection with the St. Lawrence Navigation and Power problem, and the text of the Treaty on the same subject.

The two Governments each appointed an engineer from its own services to assist the Commission in carrying out its investigation, Colonel W. P. Wooten of the Corps of Engineers, U.S. Army, being the American engineer, and W. A. Bowden, Chief Engineer of the Department of Railways and Canals, being the Canadian engineer. These engineers were supplied with instructions by the two Governments and were assisted by a competent staff on each side.

As a preliminary step the Commission conferred at Buffalo, in March 1920, with representatives of various commercial and other organizations as to the general scope of the investigation and the main aspects of the problem.

Thereafter the Commission held public hearings at various points on both sides of the international boundary from Boston, New York and Montreal in the east, to Boise and Calgary in the west. At these thirty-six separate hearings, some 7,462 pages of testimony were taken, which with the addition of documents subsequently filed with the Commission, made altogether over 8,000 pages of testimony. This vast accumulation of data was afterwards summarized and analyzed in a volume of 706 pages with a very complete index. Neither hearings nor summary were, however, printed.

On July 2, 1921, the Engineering Board, consisting of Messrs. Wooten and Bowden, filed with the Commission the text of its Report on the engineering features of the investigation, together with a number of drawings. At subsequent dates detailed estimates were filed, with two separate reports on the Regulation of Lake Ontario, as well as the balance of the drawings.

In order to get all possible light on the problems, the Commission invited all interested engineers to examine the Report of Messrs. Wooten and Bowden and to submit comments or criticisms or alternative schemes.

At a meeting in Ottawa in October, 1921, the material so filed was considered by the Commission in consultation with the Engineering Board.

In November, the Hydro-Electric Power Commission of Ontario and the New York and Ontario Power Company filed with the Commission alternative plans for the development of the St. Lawrence. Hugh L. Cooper and Company had already submitted an alternative plan.

On November 14, 1921, a final hearing was held at Ottawa at which all engineers interested in the technical features of the investigation were given an opportunity of discussing both the Report of the Engineering Board and the various alternative schemes submitted.

In the report of the Engineering Board, the upper St. Lawrence is divided into five sections; first, Montreal harbour to deep water in Lake St. Louis; second, deep water in Lake St. Louis to outer end of breakwater at Lake St. Francis, terminus of proposed ship canal between Lake St. Louis and Lake St. Francis; third, outer end of the breakwater above mentioned to lower end of St. Regis island; fourth, lower end of St. Regis island to Chimney Point; fifth, Chimney Point to Lake Ontario.

The following is the summary of the Conclusions and Recommendations of the Engineers:—

A. That the physical conditions are favourable for improvements for navigation which will be permanent, and will have very low upkeep costs.

B. That improvement of the entire reach from Montreal to Lake Ontario for navigation alone is feasible, but the loss of the power that can be generated as a by-product in some reaches is not warranted.

C. That the development of nearly all the potential power in the river, amounting to approximately 4,100,000 horsepower, can be made as co-ordinate parts of schemes for the improvement of navigation.

D. That the simultaneous development of such a vast quantity of power is not a sound economic procedure, as a market to take this output is not now in existence, and can not be expected to spring into being at once.

E. That the sound method of procedure is to improve for navigation alone those reaches where side canals and locks can most economically be used, and where the development of the power at some future time is not interfered with by the proposed improvement; and in that part of the river where the construction of locks and dams offers the most feasible means of improving navigation to provide for the development of the incidental power obtainable as a result of the heads created by the dams.

F. That the improvement of the first division, from Montreal Harbour to Lake St. Louis, be made by locks and side canal on the Ville Emard route, as shown on drawings No. 1, P1, 2, and P2. That the canal sections be excavated for a depth of 25 feet, and a bottom width varying from 220 feet in through cuttings to 450 feet in submerged or submarine channels. That provision for the future widening of this waterway be made from Victoria Bridge to west of the town of Verdun. That the locks be built for an eventual depth of 30 feet over the sills. A detailed description of the improvement will be found in paragraphs 28 to 45. The cost for this improvement is estimated to be $55,783,000. The annual cost of operation, maintenance, and depreciation will be $350,000. That whenever 30-foot depth for navigation is warranted the additional work required in the first division to obtain the same will be the construction of a concrete dam, with control gates across the river at the Lachine Rapids, and the raising of the side walls of the canal sections at an estimated cost of $12,944,000.

G. That the ice conditions in this division of the river make the development of power more uncertain and more expensive than at other sites higher up, and the head that would be available is dependant to a considerable extent on the amelioration of ice conditions by power development in division No. 2, which development should be made before that in division No. 1 is begun. When the development of this power is required it can be made by the expenditure of $83,797,000 in addition to that required to complete the improvement for 30-foot navigation.

H. That the improvement of the second division from Lake St. Louis to Lake St. Francis can be made in either of two ways. The first of these is by means of a side canal from Melocheville to Hungry Bay with flight locks at Melocheville, as shown on drawings No. 4, P4, 5, and P5, and as described in paragraphs 58 to 64. The estimated cost of the works for a depth of 25 feet, a least prism width at bottom of 220, and with banks and bridges placed for a future widening to 400 feet, and locks and other structures designed for a depth of 30 feet, is $36,590,000. The annual cost of operation, maintenance, and depreciation will be $400,000. That the estimated cost of deepening the canal in future so as to afford a depth of 30 feet is $3,110,000. That the development of the power in this stretch of the river can be made in future without interfering with the use of these navigation works. The amount of power that could be developed in this manner would be about 1,560,000 horsepower, and the cost is estimated at $151,688,000.

I. That an alternative method of improving the division from Lake St. Louis to Lake St. Francis is by means of a dam across the river about halfway between the head of Lake St. Louis and the foot of Lake St. Francis and a side canal with two locks from the pool created by this dam to the Vaudreuil arm of Lake St. Louis. It also requires a partial dam and a lock

at Coteau Rapids. The estimated cost of this waterway for a depth of 25 feet, a least prism width of 220 feet, and with locks and other structures designed for 30 feet, is $49,709,000. The annual cost of operation, maintenance, and depreciation will be $400,000. The cost to deepen it to 30 feet at a later date is $5,481,000, and the amount of power that could be developed by the construction of a power canal from the pool above the dam at Point au Biron to a power house just north of Cascades Point, would be about 1,560,000 horsepower, and its cost is estimated at $124,468,000.

J. That if the alternate method were adopted the cost of the future development of power in this stretch would be $27,220,000 less than if the first method were adopted. Present injurious ice conditions in the river below would be mitigated by the adoption of this project. But these benefits would be secured by an increase in first cost of the navigation improvements of $13,119,000, and by an additional increase of $2,371,000 when 30-foot navigation is required. The eventual saving would therefore be $11,730,000, but if the development of power were delayed more than 11 years, interest being taken at 6 per cent, the advantage in cost would lie with the first project. It is believed that the power recommended for development in the fourth division will meet all market requirements for more than 11 years. For this reason the project for an improvement by canal from Melocheville to Hungry Bay is recommended in preference to the alternate project.

K. That the improvement of the third division, Lake St. Francis to the head of St. Regis Island, be carried out by the dredging of a channel 450 feet wide and 25 feet deep at low water. The estimated cost of the recommended improvement is $1,158,000. The annual maintenance cost will be $30,000. That an additional 5-foot depth (same bottom width of channel) can be secured through this division at any future time without interfering with navigation and at an estimated cost of $662,000.

L. That the improvement of the fourth division from the foot of St. Regis Island below Cornwall to Chimney Point near Ogdensburg be made by a dam at Long Sault Rapids and side canals with locks from the pool created by this dam to a junction with the river at Cornwall; also by a dam with side canal and lock at Ogden Island near Waddington, N.Y.; by considerable channel enlargement below Cornwall and in the stretch between the head of Ogden Island and deep water above Galop Rapids, which is made necessary to secure the depth required to meet the changed ice and flow conditions in the river which will result from the construction of the dams above described; and by the development of the power incidentally made available by raising the normal water level. The works for this improvement are shown on drawings Nos. 9 to 14, inclusive, and P9 to P14, inclusive, and are described in paragraphs 99 to 157.

The project recommended provides a depth of 30 feet in all lock structures and a depth of 25 feet in channels except where a greater depth is required to discharge, without unduly great velocities, the water from Lake Ontario under the new conditions created by the works proposed. That the estimated cost of this project, including the installation of hydraulic and electrical machinery for the development of the power, is $159,097,200. That the power output will be about 1,464,000 horsepower. That the annual cost of operation, maintenance, and depreciation will be $1,762,000, of which $1,457,000 is properly chargeable to the development of power. That the estimated cost for securing 30 feet depth for navigation in the future is $1,270,180 additional.

M. That the execution of the project as recommended will make it possible at a later date to raise the structures at Barnhart Island and to dredge the tailrace so as to fully utilize whatever head the operation of the works may show to be economically practicable.

N. That the improvement of the fifth division will require the removal of certain shoals and the widening and straightening of the present channel. The estimated cost of the work is $100,000, and the annual cost of operation and maintenance is $20,000.

O. That the total cost of improvement from Montreal to Lake Ontario, as recommended above, to afford 25 feet at present, with such provisions that a 30-foot depth may be secured at a later date without interfering with the use of the waterway, is $252,728,200. This includes the cost of developing 1,464,000 horsepower. That the total annual cost of operation, maintenance, and depreciation of these works is $2,562,000. Of this sum $1,457,000 is properly chargeable to the operation, maintenance, and depreciation of power plants. That the estimated cost of increasing the navigable depth throughout the entire stretch to 30 feet at a later date is $17,986,180.

P. That if the improvements are carried on simultaneously it will be possible to complete them in eight years from the time the work is begun, if funds are made available as fast as needed.

Q. That the construction of the Ogden Island Dam affords a control over the level of Lake Ontario and the flow in the St. Lawrence River. That this control can be exercised so as to raise the mean level of Lake Ontario without causing it to fluctuate beyond the limits which it has reached in previous years. But that the studies which have been made of this problem fail to show that any very great increase in the natural low-water flows can be made for the benefit of either power or navigation in Montreal Harbor and the ship channel below. Independent studies of results to be obtained by the application of different rules for the control of flow in the St. Lawrence have been made by the two engineers and are appended hereto. The studies are based on different opinions as to the practicability of permitting flows in excess of certain amounts during the winter months. Neither engineer assumes any responsibility for the studies of the other or the assumptions on which they are based, but the conclusions to be drawn from either of the two studies are those given above.

R. That the more intangible assets to be derived from this improvement, such as the development of industries in both countries, the advantages of deep-water navigation from the ocean to the Great Lakes, the saving of coal, and the improvement in railroad freight conditions, while of great importance to the two countries, are not considered in this report, as the engineers do not understand that their instructions cover an investigation of these matters.

In preparing their estimates for the various projects, it was assumed that the locks would have an inside length of 860 feet and a width of 80 feet, these dimensions being similar to those of the new Welland Ship Canal. The prism width adopted was 220 feet for 25-foot navigation and 200 feet for 30-foot navigation, in land sections where the waterway is lined on either side by embankments or walls, while in entirely submerged or submarine channels the width estimated on is 450 feet, the same width that is now in use in the ship channel below Montreal.

On December 19, 1921, the Commission completed and signed its Report, which was thereupon filed with the two Governments.

. After analyzing the great mass of engineering and economic data gathered at the public hearings and otherwise, the Commission summarized its conclusions as follows:

To sum up as briefly as possible its conclusions in the matter of the proposed improvement of the St. Lawrence River between Lake Ontario and Montreal, the Commission finds nothing in the evidence to warrant the belief that ocean-going vessels of suitable draft could not safely navigate the waters in question as well as the entire waterway from the Gulf of St. Lawrence to the head of the Great Lakes, or that such vessels would hesitate to do so if cargoes were available.

It finds that of the various alternative routes mentioned from the interior to the seaboard, none offers advantages comparable with those of the natural route by way of the St. Lawrence.

As to the economic practicability of the waterway, the Commission finds that, without considering the probability of new traffic created by the opening of a water route to the seaboard, there exists to-day, between the region economically tributary to the Great Lakes and overseas points as well as between the same region and the Atlantic and Pacific seaboards, a volume of outbound and inbound trade that might reasonably be expected to seek this route sufficient to justify the expense involved in its improvement.

It finds that, as between the American and Canadian sides of the tributary area, the former contributes very much the larger share of this foreign and coastwise trade, and in all probability will continue to do so for many years to come. The benefits to be derived from the opening of a water route to the sea will therefore accrue in much larger measure to American than to Canadian interests, though it is reasonable to assume that eventually the advantages may be more evenly distributed.

It finds that the existing means of transportation between the tributary area in the United States and the seaboard are altogether inadequate, that the railroads have not kept pace with the needs of the country, but that this does not apply to the Canadian side of the area, where railway development is still in advance of population and production.

While the Commission is conscious of the fact that war conditions had something to do with the dislocation of railway traffic on the United States side of the boundary, and that various other factors must be taken into account, such as the congestion of traffic at certain critical points between the West and the Atlantic seaboard commonly referred to as " bottle-necks," and the abnormal demand for cars at certain times of the year to carry the peak load of the harvest, it is convinced that the fundamental difficulty lies rather in the phenomenal growth of population and industry throughout the middle western and western States, a growth which the railroads have failed to keep pace with.

The solution of the problem, in the opinion of the Commission, lies in the utilization of every practicable means of communication, and particularly of the wonderful natural waterway extending from the Atlantic into the very heart of the continent, together with the development of such a system of co-operation between railways and waterways as would at one and the same time bring the load the railways have to carry within practicable limits, and give the West an additional route for its foreign and coastwise trade.

Experience has demonstrated not only the tremendous importance of water communication to the foreign commerce of any country but also the manifest advantages of linking up rail and water routes. It is beyond question that the phenomenal industrial development of Great Britain in modern times has been due very largely to her ready access to the sea. Great

Britain has no resources of iron, yet she has built up gigantic steel industries; she grows no cotton, yet she supplies half the world with cotton goods; she produces very little wool, yet her woollen mills have developed into an enormous industry. Her merchant marine sail the seven seas, bringing to her shores the raw materials she needs for her industries, and carrying back the finished products. The sea, that most efficient, most adaptable, most far-reaching, most economical of thoroughfares, possessing practically all the advantages of land transportation with few of its disadvantages, has made Great Britain prosperous.

And what water transportation has done for Great Britain it has done in greater or less degree for other nations in other times. Access to the sea gave the diminutive Republic of Venice preeminence in the Mediterranean. It transformed little Holland from a comparatively obscure province into a great maritime nation. It gave to Spain her period of greatness. It brought Germany before the war within almost measurable distance of supremacy in the foreign trade of the world.

The conclusion is obvious that, if countries that had for the most part to import their raw materials from abroad were able to build up a great foreign trade because of their ready access to the sea, the region economically tributary to the Great Lakes, with its limitless resources, its raw materials within easy reach, its facilities for industrial expansion, can hardly fail to become an even greater factor in the world's markets than it is to-day, if given a practicable and efficient water route to the sea.

Of scarcely less importance is the linking up of land and water routes. Here also the experience of Europe is illuminating. Belgium and England are the most densely populated portions of Europe, and both are preeminently industrial nations. Each possesses a network of railways reaching into every corner of the country, yet each is to-day, despite its very short rail haul to tidewater, finding it necessary, in order to give adequate service to congested areas, to link up the railways and the highways with the inland waterways. Despite the difference in area between these countries and the region tributary to the Great Lakes, transportation conditions are not altogether dissimilar, particularly in the more congested areas of the Middle West. One finds in such a district as that around the south shore of Lake Michigan much the same conditions of a rapidly increasing concentration of population and industry, with a corresponding concentration of rail lines, that is so noticeable in England and Belgium. And similar conditions are quite evidently developing in the territory immediately tributary to Detroit, Cleveland, and other middle-western cities. When these cities and their tributary territory are given access to the sea, they will find it necessary, in order to secure the maximum benefits from the new route, to coordinate their railways and highways with the great waterway that will be common to them all. The advantages of co-operation will be found as real in this case as in Europe, although the remedy may be somewhat different in character.

An example on this continent of the effective coordination of rail and water services is found in the Canadian Pacific Railway, which, in conjunction with its rail system extending from ocean to ocean, maintains lines of steamers not only on the Atlantic and the Pacific but also on the Great Lakes and the inland waters of British Columbia.

The whole question of the distribution of cost has given the Commission some concern. If the area to be benefited were all in one country the problem of financing the improvement would be a comparatively simple one, but as the matter stands the situation is complicated not merely by the fact that two neighbouring countries are joining in the project, but that these countries are unequal in population, unequal in wealth, unequal

in their ability to make effective use of the waterway. That is the situation to-day, but it does not necessarily follow that it will always be the situation. As the years go by the relative position of the two countries will doubtless change, and the disproportion between their population, wealth, and commerce may gradually diminish. In the meantime the fair and reasonable plan appears to be to divide the cost in proportion to the benefits each receives.

Objection may be made that the proposed principle of dividing the cost in proportion to the benefits each country derives from the improvement could hardly be put into effect until the works had been completed and in operation for a sufficient period to secure reliable data on the subject. For the intervening period, however, the Commission believes that there are already available authoritative statistics on which to base a tentative decision as to the interest each country is likely to have in the waterway.

Another factor in the situation that should not be lost sight of is the peculiar relationship to the proposed improvement of the New Welland Ship Canal, a portion of which is now under construction. As pointed out in an earlier part of this report, the completion of the Welland Ship Canal and the adoption and completion of the St. Lawrence improvement would remove the only barrier to the creation of a deep-water route from the head of the lakes to the sea. This would give at least 25-foot navigation from the sea up to the Detroit River, with a present minimum of about 20 feet above Lake Erie. Although entirely outside the strict terms of the reference submitted to it by the two Governments, the Commission has been impressed by the fact that the New Welland Ship Canal is such an integral part of the waterway, and is so inseparably interwoven with the project under immediate consideration, that it should properly be considered as a part of the whole scheme and the expense of its construction should be apportioned between the two Governments upon the same basis as the works recommended for the upper St. Lawrence.

In other words, each country should be debited with its share of the entire cost of all works necessary for navigation, including the cost of the Welland Ship Canal, based upon the proportion the cargo tonnage carried to and from its own ports by way of the St. Lawrence bears to the entire tonnage by the same route. The ratio to be charged to each obviously would require to be readjusted periodically.

In regard to the water-power side of the question, by the language of the treaty as well as the obvious intention of the reference, water-power must be regarded as subsidiary to navigation. Statements were repeatedly made during the hearings to the effect that while the movement for improving the St. Lawrence was nominally in the interests of navigation, it was really being engineered by water-power interests to serve their own ends. The Commission is confident that there is no justification whatever for these assertions. As a matter of fact, as already stated, very little testimony of any kind was offered at the hearings upon the power side of the question, public attention being apparently centered on the economic practicability of the undertaking as a navigation route.

For the purposes of the conclusions, recommendations, and answers to questions, "navigation works" shall be deemed to mean and include all works of every kind and description required for the proposed improvement of the St. Lawrence between Montreal and Lake Ontario other than and except superstructures, machinery, plant, and equipment for the development and utilization of power in connection with such improvement; and "power works" shall be deemed to mean and include all superstructures and all machinery, plant, and equipment required for the development and utilization of power in connection with the said improvement.

In apportioning between the two countries the water-power capable of development in the international section of the St. Lawrence, each country should be charged with such quantities of power as are set apart to meet the requirements of existing plants.

In regard to the distribution between the two countries of the cost of "power works," the Commission is of the opinion that as each country will be entitled to half the available power in the international section of the river, the cost of the works necessary solely for the development of that power should be borne equally by each country. It is further of the opinion that the cost of "navigation works" required for the combined use of navigation and power over and above the cost of works necessary for navigation alone should be apportioned equally between the two countries.

As elsewhere noted, it was repeatedly stated by those who appeared before the Commission that the water-power developed on the St. Lawrence would be sufficiently valuable to carry a considerable proportion, if not the whole, of the cost of the undertaking both for navigation and power. The Commission desires to emphasize the point that if this prediction should prove well founded, nothing in the Commission's conclusions and recommendations as embodied in this report need conflict with the charging to water-power by either country of any proportion of its share of the entire cost that may eventually be found desirable.

In regard to the method of control, the Commission is conscious of the fact that the peculiar character of the St. Lawrence, partly international and partly national, creates an unusual situation, and it believes that, in order to combine the fullest possible liberty of action on the part of each country in its own territory, with the efficient co-ordination of the several parts of the completed improvement, all "navigation works" lying wholly within one country and capable of economic and efficient administration as complete and independent units, should be maintained and operated by the country in which they are located; that "navigation works" not lying wholly within one country and not capable of economic and efficient administration as complete and independent units, should be maintained and operated by an international board on which each country would have equal representation; and that this board should also have the right of inspection of "navigation works" lying wholly within one country, for the purpose of insuring economy and efficiency. The Commission is further of the opinion that all "power works" should be built, maintained, and operated by the country in which they are located.

An important result of the proposed improvement, if carried out, will be the extent of damage resulting from flowage due to the higher levels maintained in the St. Lawrence. This damage is estimated by the engineering board at about $6,000,000. The Commission is of the opinion that there should be an exhaustive investigation of the extent and character of the damage as soon as the plan of development has been finally accepted.

Finally, the Commission is strongly of the opinion that the subject matter of this investigation is one of such extraordinary importance to the people of the two countries, and involves engineering problems of such magnitude and diversity, that no effort should be spared to secure a plan which will beyond all reasonable doubt obtain from the upper St. Lawrence its maximum efficiency in navigation and power. To this end the Commission believes that, before any particular scheme is finally adopted, all the available engineering data, including the report and plans of the engineering board and all comments thereon or alternative plans, should be referred to a special technical board for careful consideration and report.

The following were the Commission's recommendations, based on the above conclusions:—

(1) That the Governments of the United States and Canada enter into an arrangement by way of treaty for a scheme of improvement of the St. Lawrence River between Montreal and Lake Ontario.

(2) That the New Welland Ship Canal be embodied in said scheme and treated as a part thereof.

(3) That the proposed works between Montreal and Lake Ontario be based upon the report of the engineering board accompanying this report, but that before any final decision is reached the report of the board, together with such comments, criticisms, and alternative plans as have been filed with the Commission be referred back to the board enlarged by other leading members of the engineering profession, to the end that the whole question be given that further and complete study that its magnitude and importance demands, and that after completion the administrative features of the improvement be carried out as set forth in recommendations 7 and 8 hereof.

(4) That there shall be an exhaustive investigation of the extent and character of the damage through flowage involved in the plan of development finally adopted.

(5) That, assuming the adoption of the plans of the engineering board, or of other plans also involving a readjustment of the international boundary, in order to bring each of the power houses on its own side of the boundary, appropriate steps be taken to transfer to one country or the other, as the case may be, the slight acreage of submerged land involved.

(6) That Canada proceed with the works necessary for the completion of said New Welland Ship Canal in accordance with the plans already decided upon by that country.

(7) That such "navigation works" as do not lie wholly within one country or are not capable of economic and efficient construction, maintenance, and operation within one country as complete and independent units, be maintained and operated by a board hereinafter called "the International Board," on which each country shall have equal representation.

(8) That such "navigation works" as lie wholly within one country and are capable of economic and efficient construction, maintenance, and operation as complete and independent units be maintained and operated by the country in which they are located with the right of inspection by the said International Board to insure economy and efficiency.

(9) That "power works'" be built, installed, and operated by and at the expense of the country in which they are located.

(10) That, except as set forth in recommendation (11), the cost of all "navigation works" be apportioned between the two countries on the basis of the benefits each will receive from the new waterway: *Provided,* That during the period ending five years after completion of the works—and to be known as the Construction Period—the ratio fixing the amount chargeable to each country shall be determined upon certain known factors, such as the developed resources and foreign and coastwise trade of each country within the territory economically tributary to the proposed waterway, and that that ratio shall be adjusted every five years thereafter and based upon the freight tonnage of each country actually using the waterway during the previous five-year period.

(11) That the cost of "navigation works" for the combined use of navigation and power over and above the cost of works necessary for navigation alone should be apportioned equally between the two countries.

The Commission made the following formal answers to the questions embodied in the reference:

Question I.—What further improvement in the St. Lawrence River, between Montreal and Lake Ontario, is necessary to make the same navigable for deep draft vessels of either the lake or ocean-going type; what draft of water is recommended; and what is the estimated cost?

In answering this question, the Commission is requested to consider:—

(*a*) Navigation interests alone, whether by the construction of locks and dams in the river; by side canals with the necessary locks; or by a combination of the two.

(*b*) The combination of navigation and power interests to obtain the greatest beneficial use of the waters of the river.

Answer.—(*a*) The Commission believes that the greatest beneficial use of the waters of the St. Lawrence River between Montreal and Lake Ontario may be obtained by a combination of navigation and power development in the international section and of navigation alone in the national section with power development therein at some future date.

(b) The Commission approves of a combination of dams and side canals with locks in the international section, and side canals with locks in the national section, as recommended by the engineering board.

(*c*) The draft of water recommended is 25 feet in the canals and 30 feet on the sills of the locks.

(*d*) The estimated cost of the completed work between Montreal and Lake Ontario as recommended by the engineering board is about $252,000,000. To this must be added the cost of the New Welland Ship Canal in order to ascertain the total expenditure involved.

Question II.—Which of the schemes submitted by the Government or other engineers is preferred, and why?

Answer.—Of the schemes submitted by the engineering board, the one recommended by them is preferred. Plans and suggestions in connection with certain portions of the river were submitted by other engineers, but the only complete schemes before the Commission are those of the engineering board. For reasons already advanced the Commission recommends a further examination and study of the plans of the engineering board, when due consideration may be given to the studies and extensive report of the Hydro-Electric Power Commission of Ontario, as well as to the other reports presented to the Commission.

Question III.—Under what general method of procedure and in what general order shall the various physical and administrative features of the improvement be carried out?

Answer.—(*a*) So far as the physical features of the improvement are concerned, the Commission believes that the works at and near the Long Sault Rapids, whose completion may be expected to require the greatest amount of time, should be commenced as soon as funds are available; and that all other works, both in the international and national sections of the river, should be commenced in time to insure their completion at approximately the same time as the Long Sault works. This method and order of procedure would at one and the same time secure through deep-water navigation, and make possible the development of power at the earliest practicable date.

(*b*) In regard to the administrative features of the improvement, the Commission has set forth in the foregoing recommendations the method of procedure which in its opinion would most efficiently meet the requirements of the situation.

Question IV.—Upon what basis shall the capital cost of the completed improvement be apportioned to each country?

Answer.—(*a*) The capital cost of "navigation works" and of the New Welland Ship Canal to be apportioned between the two countries on the basis of the benefits to be derived by each country from the use of the waterway.

(*b*) The capital cost of "power works" to be borne by the country in which they are located.

(*c*) The capital cost of "navigation works" for the combined use of navigation and power over and above the cost of works necessary for navigation alone to be apportioned equally between the two countries.

Question V.—Upon what basis shall the costs of operation and maintenance be apportioned to each country?

Answer.—The apportionment of costs of operation and maintenance of all works both for the purpose of navigation and also of power to be on the same basis as costs of construction of such works respectively.

Question VI.—What method of control is recommended for the operation of the improved waterway to secure its most beneficial use?

Answer.—The Commission recommends:—

(*a*) That such "navigation works" as do not lie wholy within one country or are not capable of economic and efficient operation within one country as complete and independent units, be operated under the direction of the International Board as set forth in recommendation No. 7;

(*b*) that all "navigation works" other than those particularly mentioned in (*a*) be operated by the country in which they are located with the right of inspection by the International Board as set forth in recommendation No. 8;

(*c*) that "power works" be operated by the country in which they are located as set forth in recommendation No. 9.

Question VII.—Will regulating Lake Ontario increase the low water flow in the St. Lawrence Ship Channel below Montreal? And if so, to what extent and at what additional cost?

Answer.—The Commission is of the opinion that regulating Lake Ontario will increase the low water flow in the St. Lawrence Ship Channel below Montreal; but the extent of the increase can only be determined after practical experience has indicated the best scheme of regulation to adopt. This increase in the low water flow will be secured by the works provided in connection with the improvement of the upper St. Lawrence, and consequently at no additional cost.

Question VIII.—To what extent will the improvement develop the resources, commerce, and industry of each country?

Answer.—The Commission has brought together a very considerable volume of data relating to the resources, commerce, and industry of the area that it is believed would be economically tributary to the proposed deep waterway, and has based certain conclusions upon that data, which are embodied in this report. It is impossible to state in more specific terms the extent to which the improvement would develop the resources, commerce, and industry of each country.

Question IX.—What traffic, both incoming aud outgoing, in kind and quantity, is likely to be carried upon the proposed route both at its inception and in the future, consideration to be given not only to present conditions, but to probable changes therein resulting from the development of industrial activities due to availability of large quantities of hydraulic power?

Answer.—To this question also it is impossible to give a specific answer, in the absence of definite information as to all the factors that will enter into the problem. The Commission has brought together authoritative information as to the existing traffic between the tributary area and overseas points as well as between the same area and coastwise points on this continent, and has reached the general conclusion that sufficient traffic will seek the new water route, irrespective of new traffic created as the result of the opening of that route, to justify its construction. The Commission has so much confidence in the virility and resourcefulness of the people of these two countries that it is convinced the traffic available for the new waterway will rapidly increase with the further development of the area tributary thereto, and that the creation of new hydraulic power in connection with the waterway will stimulate industrial growth both in manufactures and transportation.

Stated in the fewest possible words, the Commission recommended the improvement of the St. Lawrence between Lake Ontario and Montreal by providing a 25-foot ship channel throughout the entire route, and the development of 1,464,000 horse-power in the international section at an estimated cost of $252,728,200.

In view of the magnitude and importance of the project, the Commission recommended that before any final decision was reached, the report of the engineers, together with all other relevant data should be reviewed by a larger board of engineers to be appointed by the two Governments.

Pursuant to this recommendation, the two Governments, in 1924, appointed a joint engineering board consisting of Major-General Edgar Jadwin, Colonel William Kelly and Lieut. Colonel George B. Pillsbury, all of the U. S. Corps of Engineers, and Duncan W. McLachlan of the Department of Railways and Canals of Canada, Olivier O. Lefebvre, Chief Engineer of the Quebec Streams Commission, and Brig.-General Charles Hamilton Mitchell of Toronto.

In 1925 this enlarged Board was asked to consider and supply answers to the following questions:

(1) Is the scheme for the improvement of the St. Lawrence waterway, presented by the Board in its report of June 24, 1921, practicable, and does it provide to the best advantage, at this time and ultimately, for the development of the capacities and possibilities of the waterway?

(2) What alternative scheme, if any, would be better adapted to secure the ends desired, due consideration being given,—

  (*a*) To any special international or local interests having an importance justifying exceptional consideration; and

  (*b*) To the extent and character of the damage through flooding and the probable effect of the works upon the formation of ice and the consequent effect on the flow of the river?

(3) Should the estimates of cost be revised and, if so, what are the revised estimates of cost having regard to alternative schemes?

(4) In order to assist either Government to allocate the amounts chargeable to navigation and power, what would be the respective estimated costs for improving the river for navigation alone and for power alone?

(5) To what extent may water levels in the St. Lawrence river at and below Montreal, as well as the river and lake levels generally, be affected by the execution of the project?

Other points covered by the instructions had to do with the effect of diversions, including that of Chicago, upon the St. Lawrence watershed, the manner in which construction, maintenance and operation of such of the proposed works as were international might be supervised, whether the Welland Ship canal should be embodied in the scheme and treated as part thereof, and what time might be expected to be consumed in the construction of the waterway.

In July, 1927, the joint engineering board submitted its report to the two Governments with plates, plans, and a series of Appendices. In this report the engineers, after discussing the various phases of the problem, summarize as follows their recommendations:

Improvement Proposed

In summary, the plans recommended by the Board for the improvement of the river will provide to the best advantage for a navigation route through 183 miles of river and lake from Lake Ontario to Montreal harbour, with a total not exceeding 25 miles of restricted canal navigation, and with not more than nine locks. It will be crossed by but eight bridges. The plans include power houses with an ultimate installed capacity of from 2,619,000 to 2,730,000 horse-power, and permit the eventual development with installed capacity of approximately 5,000,000 horse-power which is the full power potentiality of the river.

Initial Expenditure Required

The estimated expenditures required to open navigation with channels 25 feet in depth, with an initial power development having one-half the ultimate installed capacity of the power houses first constructed (the installation of the remainder being deferred to await the growth of the market) is as follows:

(1*a*) Total cost of improvement if with a single-stage development in the international rapids section (1,365,000 horse-power initially installed) .. $350,100,000

or

(1*b*) Above improvement before channels are enlarged to ensure winter operation .. $337,100,000

or

(2*a*) Total cost of improvement if with a two-stage development in the international rapids section (1,365,000 horse-power initially installed) .. $385,500,000

or

(2*b*) Above improvement if the initial power installation in the international rapids section is all made at the lower (Barnhart island) plant .. $361,600,000

Cost of Works Complete

After all of the machinery in plants recommended by the Board has been installed, these costs will become respectively:

(1) If with a single-stage development of the International Rapids Section (2,730,000 installed horse-power) .. $394,000,000

or

(2) If with a two-stage development of the International Rapids Section (2,619,000 installed horse-power) .. $423,600,000

In 1932 the Joint Board of Engineers was reconvened to consider certain additional matters involved in the Investigation, and particularly the project for a two-stage development, with the upper dam at Chrysler Island. The Board's report on this further inquiry was published in 1932.

Between the time when the Joint Board of Engineers made its first report and was reconvened in 1932, a conference was held between the Canadian

members of the Board and F. A. Gaby and T. H. Hogg, representing the Province of Ontario. The result of this conference was a Report published in 1930, which embodied the following conclusions:

(*a*) That the International Rapids Section of the St. Lawrence river should be improved by means of what is commonly known as a two-stage or double-stage project.

(*b*) That the upper dam and power houses of such two-stage project should be placed at Chrysler Island.

(*c*) That the lower dam of such two-stage project should be placed at the head of Barnhart Island.

(*d*) That the power houses of the lower development should be placed across the channel between Barnhart Island and the Canadian mainland, with Bergen Lake, situated north of Sheek Island, constituting part of the headrace leading to these power houses.

Concurrently with the review of the engineering aspects of the Investigation by the enlarged Board of Engineers, two Committees were set up, one American and the other Canadian, to make a similar survey of the economic evidence. The American body was known as the United States St. Lawrence Commission, and the Canadian body as the Canadian National Advisory Committee. The former reported in 1926 and the latter in 1928.

The conclusions of the United States Commission, of which Herbert Hoover was Chairman, were as follows:—

First.—The construction of the shipway from the Great Lakes to the sea is imperative both for the relief and for the future development of a vast area in the interior of the continent.

Second.—The shipway should be constructed on the St. Lawrence route, provided suitable agreement can be made for its joint undertaking with the Dominion of Canada.

Third.—That the development of the power resources of the St. Lawrence should be undertaken by appropriate agencies.

Fourth.—That negotiations should be entered into with Canada in an endeavor to arrive at agreement upon all these subjects. In such negotiations the United States should recognize the proper relations of New York to the power development in the International Section.

The Canadian Committee, first under the chairmanship of Hon. George P. Graham, and later of Senator W. E. Foster, concurred in the finding of the Joint Board of Engineers that the project was feasible, but recommended 27 feet in the connecting channels instead of 25 feet. In regard to the financial aspects of the project, the Committee was of the opinion that in dividing the costs, Canada should be credited with the amounts she had already spent on the Welland Ship canal and elsewhere between Montreal and the head of the Lakes, and that the United States might reasonably be expected to pay the cost of the entire work, both for navigation and power, in the International section. The Committee also recommended that all dams and other works in the International section should be designed and built under the supervision of an international commission.

On receipt of the Report of the Canadian National Advisory Committee, the Canadian Government took up with the Government of the United States, the drafting of a treaty designed to make provision for the improvement of the St. Lawrence for navigation and water-power; and at the same time it referred to the Supreme Court of Canada certain questions in controversy between the

federal and provincial authorities as to the division of control and interest in water-powers, such as those that would result from the St. Lawrence development.

The Treaty for the construction of the St. Lawrence Deep Waterway was signed at Washington, July 18, 1932. It recognizes in the first place "that the construction of a deep waterway, not less than 27 feet in depth, for navigation from the interior of the continent of North America through the Great Lakes and the St. Lawrence River to the sea, with the development of the water power incidental thereto, would result in marked and enduring benefits to the agricultural, manufacturing and commercial interests of both countries."

The several articles of the Treaty set out what works are to be constructed in the international section of the St. Lawrence river, make provision for the establishment of a temporary St. Lawrence International Rapids Section Commission and specifies its powers and responsibilities. It declares the right of citizens of both countries to navigate the St. Lawrence River and the Great Lakes system, including present and future canals. It limits the diversion of water through the Chicago Drainage Canal. It provides that no diversion of water other than that of Chicago from the Great Lakes system or from the international section to another watershed shall hereafter be made except by authorization of the International Joint Commission. It also provides that in the event of diversions being made into the Great Lakes system from watersheds wholly within the borders of either country, the exclusive rights to the use of water equivalent in quantity to any so diverted shall be vested in the country diverting such waters. Compensation works are to be built by the United States in the Niagara and St. Clair rivers to compensate for the diversion at Chicago, and by Canada to compensate for diversion for power purposes other than power used in the operation of the Welland canals.

Attached to the treaty is a schedule making provision for the operation of the St. Lawrence International Rapids Section Commission.

On July 11, 1932, an Agreement was signed between the Dominion of Canada and the Province of Ontario, providing for the development of the Canadian share of water-power in the international rapids section for the benefit of Ontario, in the event of the treaty being ratified, and the share of the cost of the works in that section to be paid by Ontario.

Under Article VIII of the Agreement, Canada and Ontario mutually agree that water may be diverted from the Ogoki river flowing into Hudson Bay, into the St. Lawrence watershed, subject to certain terms and conditions.

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Part 1.—Reports prepared by the War Department as to the engineering and economic advisability of the proposed Great Lakes-St. Lawrence Improvement.

Part 2.—A Report on the Great Lakes-St. Lawrence Seaway dated January 6, 1934, prepared in the Department of Commerce.

Part 3.—Report on the Great Lakes-St. Lawrence Seaway, dealing with the matter of land and water transportation, with analysis of Interstate Commerce Commission data, furnished by the Interdepartmental Board.

Part 4.—Report on the Economic Advisability of the St. Lawrence Power Project, prepared by the Federal Power Commission with the co-operation of the Power Authority of the State of New York. (U.S. Senate Document No. 116, 73d. Cong., 2d. Sess., 1934. 2 vols.)

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III

ST. LAWRENCE DEEP WATERWAY TREATY

SIGNED AT WASHINGTON, JULY 18TH, 1932

His Majesty the King of Great Britain, Ireland and the British dominions beyond the Seas, Emperor of India, in respect of the Dominion of Canada, and the President of the United States of America,

Recognizing that the construction of a deep waterway, not less than twenty-seven feet in depth, for navigation from the interior of the Continent of North America through the Great Lakes and the St. Lawrence River to the sea, with the development of the waterpower incidental thereto, would result in marked and enduring benefits to the agricultural, manufacturing and commercial interests of both countries, and

Considering further that the project has been studied and found feasible by the International Joint Commission, the Joint Board of Engineers, and by national advisory boards, and

Recognizing the desirability of effecting a permanent settlement of the questions raised by the diversion of waters from or into the Great Lakes System, and

Considering that important sections of the waterway have already been constructed, and

Taking note of the declaration of the Government of Canada of its intention to provide, not later than the date of the completion of the deep waterway in the international section of the St. Lawrence River, for the completion of the New Welland Ship Canal, and of canals in the Soulanges and Lachine areas of the Canadian section of the St. Lawrence River which will provide essential links in the deep waterway to the sea, and

Taking note of the declaration of the Government of the United States of its intention to provide, not later than the date of the completion of the deep waterway in the international section of the St. Lawrence River, for the completion of the works in the Great Lakes System above Lake Erie which will provide essential links in the deep waterway to the sea,

Have decided to conclude a Treaty for the purpose of ensuring the completion of the St. Lawrence Waterway project, and for the other purposes aforesaid, and to that end have named as their respective plenipotentiaries:—

His Majesty the King of Great Britain, Ireland and the British dominions beyond the Seas, Emperor of India, for the Dominion of Canada:

The Honourable WILLIAM DUNCAN HERRIDGE, P.C., D.S.O., M.C., His Envoy Extraordinary and Minister Plenipotentiary for Canada in the United States of America;

The President of the United States of America:

HENRY L. STIMSON, Secretary of State of the United States of America;

Who, after having communicated to each other their full powers, found in good and due form, have agreed upon the following Articles:—

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PRELIMINARY ARTICLE

In the present Treaty, unless otherwise expressly provided, the expression:—

(*a*) "International Joint Commission" means the commission established pursuant to the provisions of the Boundary Waters Treaty of 1909;

(*b*) "Joint Board of Engineers" means the board appointed pursuant to an agreement between the Governments following the recommendation of the International Joint Commission, dated the 19th December, 1921, and the "final report of the Joint Board of Engineers" means the report dated the 9th April, 1932;

(*c*) "Great Lakes System" means Lakes Superior, Michigan, Huron, Erie and Ontario, and the connecting waters, including Lake St. Clair;

(*d*) "St. Lawrence River" means the river known by that name and includes the river channels and the lakes forming parts of the river channels from the outlet of Lake Ontario to the sea;

(*e*) "international boundary" means the international boundary between Canada and the United States of America as established by existing treaties;

(*f*) "International Section" means that part of the St. Lawrence River through which the international boundary line runs and which extends from Tibbetts Point at the outlet of Lake Ontario to the village of St. Regis at the head of Lake St. Francis;

(*g*) "Canadian Section" means that part of the St. Lawrence River which lies wholly within Canada and which extends from the easterly limit of the international section to the Montreal Harbour;

(*h*) "Thousand Islands Section" means the westerly portion of the international section extending from Tibbetts Point to Chimney Point;

(*i*) "International Rapids Section" means the easterly portion of the international section extending from Chimney Point to the village of St. Regis;

(*j*) "Governments" means the Government of the Dominion of Canada and the Government of the United States of America;

(*k*) "countries" means Canada and the United States of America.

ARTICLE I

With respect to works in the International Section, Canada agrees, in accordance with the project described in the final report of the Joint Board of Engineers,

(*a*) to construct, operate and maintain the works in the Thousand Islands Section below Oak Point;

(*b*) to construct, operate and maintain a side canal with lock opposite Crysler Island;

(*c*) to construct the works required for rehabilitation on the Canadian side of the international boundary.

ARTICLE II

With respect to works in the International Section, the United States agrees, in accordance with the project described in the final report of the Joint Board of Engineers,

(*a*) to construct, operate and maintain the works in the Thousand Islands Section above Oak Point;

(*b*) to construct, operate and maintain a side canal with locks opposite Barnhart Island;

(*c*) to construct the works required for rehabilitation on the United States side of the international boundary.

ARTICLE III

The High Contracting Parties agree to establish and maintain a temporary St. Lawrence International Rapids Section Commission, hereinafter referred to as the Commission, consisting of ten members, five to be appointed by each Government, and to empower it to construct the works in the International Rapids Section included in the project described in the final report of the Joint Board of Engineers (not included in the works provided for in Articles I and II hereof, and excluding the power-house superstructures, machinery and equipment required for the development of power) with such modifications as may be agreed upon by the Governments, out of funds which the United States hereby undertakes to furnish as required by the progress of the works, and subject to the following provisions:—

(*a*) that the Commission, in accordance with the provisions of Schedule A, attached to and made a part of this Treaty, shall be given the powers that are necessary to enable it to construct the assigned works;

(*b*) that, in so far as is possible in respect to the works to be constructed by the Commission, the parts thereof within Canadian territory, or an equivalent proportion of the total of the works, shall be executed by Canadian engineers and Canadian labour and with Canadian material; and, in so far as is possible, the remaining works shall be executed by United States engineers and United States labour and with United States material; and the duty of carrying out this division shall rest with the Commission;

(*c*) that the Parties may arrange for construction, in their respective territories, of such power-house superstructures, machinery and equipment as may be desired for the development of waterpower;

(*d*) that, notwithstanding the provisions of Article IX, the Commission shall be responsible for any damage or injury to persons or property resulting from construction of the works by the Commission, or from maintenance or operation during the construction period;

(*e*) that, upon completion of the works provided for in this Article, the Parties shall maintain and operate the parts of the works situate in their respective territories.

ARTICLE IV

The High Contracting Parties agree:—

(*a*) that the quantity of water utilized during any daily period for the production of power on either side of the international boundary in the International Rapids Section shall not exceed one-half of the flow of water available for that purpose during such period;

(*b*) that, during the construction and upon the completion of the works provided for in Article III, the flow of water out of Lake Ontario into the St. Lawrence River shall be controlled and the flow of water through the International Section shall be regulated so that the navigable depths of water for shipping in the Harbour of Montreal and throughout the navigable channel of the St. Lawrence River below Montreal, as such depths now exist or may hereafter be increased by dredging or other harbour or channel improvements, shall not be lessened or otherwise injuriously affected.

ARTICLE V

The High Contracting Parties agree that the construction of works under the present Treaty shall not confer upon either of the High Contracting Parties proprietary rights, or legislative, administrative or other jurisdiction in the terri-

tory of the other, and that the works constructed under the provisions of this Treaty shall constitute a part of the territory of the country in which they are situated.

ARTICLE VI

The High Contracting Parties agree that they may, within their own respective territories, proceed at any time to construct alternative canal and channel facilities for navigation in the International Section or in waters connecting the Great Lakes, and that they shall have the right to utilize for this purpose such water as may be necessary for the operation thereof.

ARTICLE VII

The High Contracting Parties agree that the rights of navigation accorded under the provisions of existing treaties between His Majesty and the United States of America shall be maintained, notwithstanding the provisions for termination contained in any of such treaties, and declare that these treaties confer upon the subjects or citizens and upon the ships, vessels and boats of each High Contracting Party, rights of navigation in the St. Lawrence River, and the Great Lakes System, including the canals now existing or which may hereafter be constructed.

ARTICLE VIII

The High Contracting Parties, recognizing their common interest in the preservation of the levels of the Great Lakes System, agree:—

(*a*) 1. that the diversion of water from the Great Lakes System, through the Chicago Drainage Canal, shall be reduced by December 31, 1938, to the quantity permitted as of that date by the decree of the Supreme Court of the United States of April 21, 1930;

2. in the event of the Government of the United States proposing, in order to meet an emergency, an increase in the permitted diversion of water and in the event that the Government of Canada takes exception to the proposed increase, the matter shall be submitted, for final decision, to an arbitral tribunal which shall be empowered to authorize, for such time and to such extent as is necessary to meet such emergency, an increase in the diversion of water beyond the limits set forth in the preceding sub-paragraph and to stipulate such compensatory provisions as it may deem just and equitable; the arbitral tribunal shall consist of three members, one to be appointed by each of the Governments, and the third, who will be the Chairman, to be selected by the Governments;

(*b*) that no diversion of water, other than the diversion referred to in paragraph (*a*) of this Article, from the Great Lakes System or from the International Section to another watershed shall hereafter be made except by authorization of the International Joint Commission;

(*c*) that each Government in its own territory shall measure the quantities of water which may at any point be diverted from or added to the Great Lakes System, and shall place the said measurements on record with the other Government semi-annually;

(*d*) that, in the event of diversions being made into the Great Lakes System from watersheds lying wholly within the borders of either country, the exclusive rights to the use of waters equivalent in quantity to any waters so diverted shall, notwithstanding the provisions of Article IV (*a*), be vested in the country diverting such waters, and the quantity of water so diverted shall be at all times available to that country for use for power below the point of diversion, so long as it constitutes a part of boundary waters;

(*e*) that compensation works in the Niagara and St. Clair Rivers, designed to restore and maintain the lake levels to their natural range, shall be undertaken at the cost of the United States as regards compensation for the diversion through the Chicago Drainage Canal, and at the cost of Canada as regards the diversion for power purposes, other than power used in the operation of the Welland Canals; the compensation works shall be subject to adjustment and alteration from time to time as may be necessary, and as may be mutually agreed upon by the Governments, to meet any changes effected in accordance with the provisions of this Article in the water supply of the Great Lakes System above the said works, and the cost of such adjustment and alteration shall be borne by the Party effecting such change in water supply.

Article IX

The High Contracting Parties agree:

(*a*) that each Party is hereby released from responsibility for any damage or injury to persons or property in the territory of the other, which may be caused by any action authorized or provided for by this Treaty;

(*b*) that they will severally assume responsibility and expense for the acquisition of any lands or interests in land in their respective territories which may be necessary to give effect to the provisions of this Treaty.

Article X

This Treaty shall be ratified in accordance with the constitutional methods of the High Contracting Parties. The ratifications shall be exchanged in Ottawa or in Washington as soon as practicable and the Treaty shall come into force on the day of the exchange of ratifications.

In faith whereof the respective plenipotentiaries have signed this Treaty in duplicate and have hereunto affixed their seals.

Done at the city of Washington the eighteenth day of July in the year of our Lord one thousand nine hundred and thirty-two.

W. D. HERRIDGE [L.S.]

HENRY L. STIMSON [L.S.]

SCHEDULE A

St. Lawrence International Rapids Section Commission

(*a*) The Commission, established under the provisions of Article III of this Treaty, shall function solely as an international commission established under, and controlled by, the terms of this Treaty. It shall not be subject, generally, to the legislative, to the executive or, except as hereinafter provided, to the judicial authorities in either country, but it shall be subject to this and to any subsequent agreement.

(*b*) The modifications referred to in Article III of this Treaty shall be regarded as effective when confirmed by an exchange of notes by the Governments.

(*c*) The Commission shall have power to establish orders, rules or by-laws, and such orders, rules or by-laws, together with any amendments, modifications or repeals thereof, shall be effective on confirmation by an exchange of notes by the Governments.

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(*d*) The Governments shall be entitled to inspect the plans, proposals or works under construction, and to inspect and audit the books and other records of the Commission.

(*e*) In order to enable the Commission effectively to perform the duties imposed upon it by this Treaty, it is agreed that the appropriate authorities in the countries will take such action as may be necessary to confer upon the Commission the following capacities, powers and liabilities:

1. all such specific capacities, powers and liabilities as are reasonably ancillary to the establishment of the Commission and the duties and functions imposed upon it by this Treaty; the subsequently enumerated capacities, powers and liabilities are not intended to restrict the generality of this clause;
2. the capacity to contract, to sue and be sued in the name of the Commission;
3. freedom from liability for the members of the Commission for the acts and liabilities of the Commission and, conversely, a general responsibility of the Commission for the acts of itself, its employees and agents, in the same manner as if the Commission were a body corporate, incorporated under the laws of either of the countries;
4. the power to obtain the services of engineers, lawyers, agents and employees generally;
5. the power to make the necessary arrangements for Workmen's Compensation either directly or with the appropriate authorities or agents in either country, so as to insure the workmen and their families rights of compensation equivalent to those which they would ordinarily receive in the Province of Ontario in respect to the parts of the works within Canadian territory, or the equivalent works as referred to in Article III (*b*) of this Treaty, or in the State of New York in respect to the remaining works.

(*f*) The Commission shall be subject to the jurisdiction of the Federal Courts of the two countries, respectively, that is to say, in respect to all questions arising out of the part of the works within Canadian territory or the equivalent works, as referred to in Article III (*b*) of this Treaty, the Commission shall be subject to the jurisdiction of the Exchequer Court of Canada, and, in respect to the remaining works, to the jurisdiction of the Federal Courts of first instance in the United States; and there shall also be established rights of appeal, analogous to the appeals in similar matters from the respective courts to the appropriate tribunals in the respective countries: provided, however, that in respect of a claim made upon the Commission exceeding in amount the sum of fifty thousand dollars ($50,000), either of the Governments, at any time after such claim has been tried and judgment entered in the appropriate court of first instance herein provided for, may cause the matter to be referred by way of appeal to an arbitral tribunal. Such reference shall be effected by notice from the Government invoking this proviso to the other Government and to the Court, given within ninety days of the entry of such judgment, and such notice shall give to the tribunal jurisdiction over the appeal, or cause any appeal already taken to be transferred to the tribunal. The tribunal shall consist of three members, all of whom must hold, or have held, high judicial office. One shall be appointed by each Government, and the third shall be selected by the two members so appointed; or, in the event of failure to agree, by the Governments jointly. The tribunal so established shall then have, in respect to such claim, exclusive final jurisdiction and its findings shall be binding upon the Commission.

(*g*) In view of the need for co-ordination of the work undertaken by the Commission and the development of power in the respective countries, the Commission shall have authority:

1. to make contracts with any agency in either country, which may be authorized to develop power in the International Section, for the engineering services necessary for the designing and construction of the power works;
2. to defer such parts of the power works as need to be constructed in conjunction with the installation of power-house machinery and equipment, and to make contracts with any agency in either country, which may be authorized to develop power, for constructing such deferred parts of the power works.

(*h*) The remuneration, general expenses and all other expenses of the members of the Commission shall be regulated and paid by their respective Governments and all other expenses of the Commission shall be defrayed out of the funds provided under the terms of Article III of this Treaty.

(*i*) The Governments agree:

1. to permit the entry into their respective countries within the area immediately adjacent to the International Section, to be delimited by an exchange of notes by the Governments, of personnel employed by the Commission, and to exempt such personnel from their immigration laws and regulations within such area;
2. to exempt from customs duties, excise or sales taxes, or other imposts, all supplies and material purchased by the Commission in either country for its own use.

(*j*) The Commission shall continue until its duties under Article III of this Treaty have been completely performed. The Governments may, at any time, reduce its numbers, provided that there must remain an even number of members with the same number appointed by each Government. Upon completion, arrangements will be made for the termination of the Commission and the bringing to an end of its organization by agreement between the Governments.

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North Atlantic Seaboard

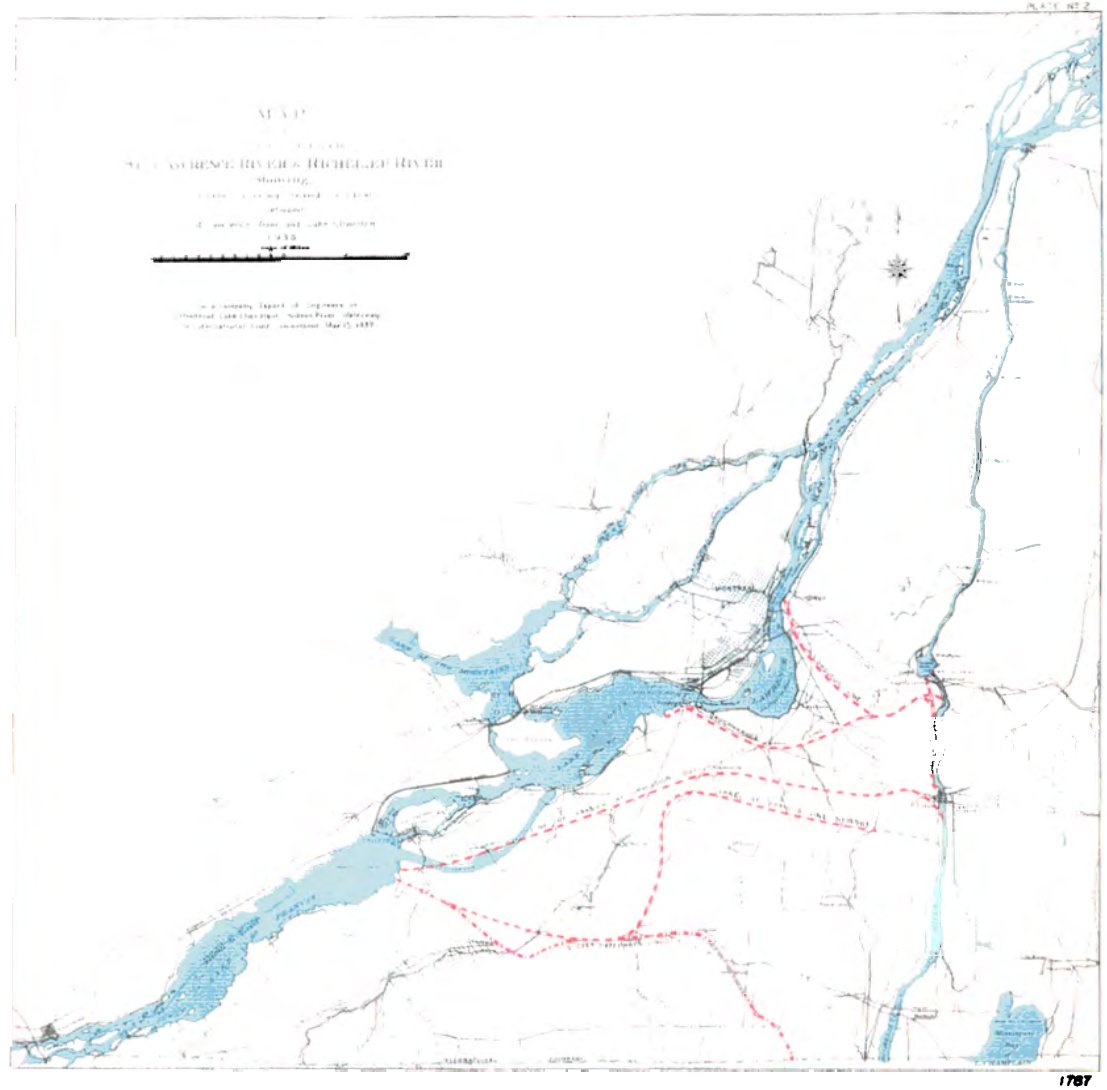
PLATE No 2
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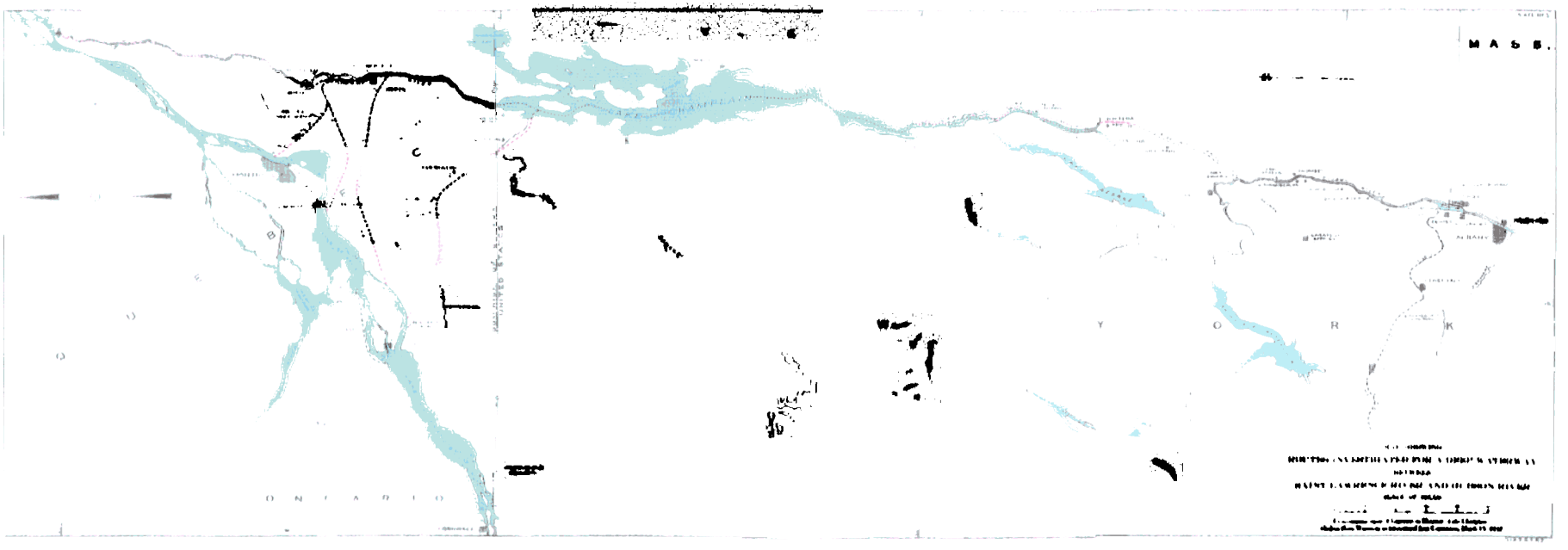
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