INTERNATIONAL JOINT COMMISSION

REPORT ON
THE LIVINGSTONE CHANNEL

APRIL 8, 1913

RECOMMENDATIONS IN REPLY TO QUESTIONS SUBMITTED BY THE GOVERNMENTS OF THE UNITED STATES AND CANADA
OCTOBER 16, 1912

TREATY OF MAY 5, 1910

WASHINGTON
GOVERNMENT PRINTING OFFICE
1913
REPORT OF THE INTERNATIONAL JOINT COMMISSION ON THE
REFERENCE BY THE UNITED STATES AND CANADA IN RE
THE LIVINGSTONE CHANNEL, DETROIT RIVER, AND THE CON-
STRUCTION OF CERTAIN DIKES AND COMPENSATORY WORKS
THEREIN FOR THE IMPROVEMENT AND SAFETY OF NAVI-
GATION.

The International Joint Commission begs leave to submit to the
Governments of the United States and Canada the following as its
"report upon the facts and circumstances of the particular ques-
tions and matters referred," together with its conclusions and recom-
mandations thereon:

LETTER OF REFERENCE.

On October 16, 1912, the United States and Canada by letter of
the Secretary of State filed with this commission at Washington, and
on the 19th day of the same month Canada and the United States
by letter of the British ambassador at Washington filed with this
commission at Ottawa, identical letters, as follows:

To the INTERNATIONAL JOINT COMMISSION of the United States and Canada.

Gentlemen: I have the honor to inform you that, at the joint request of
the Government of the United States and of the Government of the Dominion
of Canada, under the provisions of Article IX of the treaty of January 11, 1909,
between the United States and Great Britain, the questions or matters of
difference set forth below, which have arisen between them involving the
rights, obligations, or interests of each in relation to the other, or to the in-
habitants of the other, along their common frontier between the United States
and the Dominion of Canada, are hereby referred to the International Joint
Commission for examination and report upon the facts and circumstances of
the particular questions and matters referred, together with such conclusions
and recommendations as may be appropriate.

The questions so referred are as follows:
1. Under all the circumstances and conditions surrounding the navigation
and other uses of the Livingstone and other channels in the Detroit River on
either side of the international boundary, is the erection of any dike or other
compensatory work deemed necessary or desirable for the improvement or
safety of navigation at or in the vicinity of Bois Blanc Island in connection

777
with rock excavation and dredging in Livingstone Channel authorized by the river and harbor act of June 25, 1910 (36 Stats., 655), and described in House Document 676, Sixty-first Congress, second session, sundry civil act of June 25, 1910 (36 Stats., 729), sundry civil act of March 4, 1911 (36 Stats., 1405), of the United States, and now being carried out by the Government of the United States?

2. If, in answer to question 1, any dike or other compensatory works are found to be necessary or desirable, will the work or works proposed by the United States and provided for in the river and harbor act of June 25, 1910 (36 Stats., 655), and located so as to connect the north end of Bois Blanc Island to the southeast end of the existing cofferdam on the east side of Livingstone Channel, opposite and below Stoney Island, be sufficient for the purpose; and if not, what additional or other dikes or compensatory works should be constructed and where should they be located in order to serve most advantageously the interests involved on both sides of the international boundary?

I have the honor to add that the Government of the United States will be glad to assist the commission in obtaining any information which it may desire in the course of its investigation of the matters herein referred for its examination and report.

POSTPONEMENT REQUESTED BY CANADA.

At a special meeting held at Washington on November 18, 1912, the foregoing reference was laid before the commission. On November 20 the commission proceeded to consider it, whereupon Mr. John Thompson, solicitor for the attorney general of Canada, and on behalf of the Canadian Government, presented to the commission a statement as follows:

Re Livingstone Channel.

To the honorable the INTERNATIONAL JOINT COMMISSION,
Ottawa, Canada, and Washington, D. C.

GENTLEMEN: Since this reference was made the Canadian Government has undertaken an examination of the various channels, but the work has not been completed, and it requests the commission to refrain from reporting until such examination is finished.

Dated at Ottawa this 13th day of November, 1912.

The Hon. C. J. DOHERTY,
Attorney General for the Dominion of Canada.
By JOHN THOMPSON,
His Solicitor Herein.

Whereupon the commission granted the request submitted on behalf of the Canadian Government and postponed further consideration of the reference until such time as the Government of Canada would be prepared to proceed. In the meantime, on December 3, 1912, before the close of navigation, in order to expedite the investigation the commission proceeded to Detroit and made a personal examination and view of the Livingstone and other channels in the Detroit River and of the site of the proposed dike.
AMHERSTBURG'S PROTEST.

While engaged in the foregoing examination a number of the residents of Amherstburg, on the Canadian side of the Detroit River, appeared before the commission and presented a memorial in the form of a protest on behalf of the town of Amherstburg against the construction of the proposed dike or protective works mentioned in the said reference, the contemplated location of which is in the vicinity of that town. The memorial was formally presented at the hearings in Detroit, and is as follows:

To the CHAIRMAN AND MEMBERS OF THE JOINT COMMISSION:

The petition of the undersigned residents of the town of Amherstburg and townships of Anderdon and Malden humbly sheweth:

Whereas it has been proposed to construct a dam from the south end of the east spoils pile of the Stoney Island Dry Cut, in the Detroit River, to the head of Bois Blanc Island, opposite the town of Amherstburg, with a view of controlling cross currents, which might otherwise affect the navigation of the new Livingstone Channel and of maintaining the water level.

And whereas your petitioners believe that the construction of the proposed dam would, by diverting a large body of water into the narrow channel between the town of Amherstburg and Bois Blanc Island, increase the current at this point to such an extent as to render the harbor at Amherstburg practically useless; and ice brought down by such increased current would destroy the docks and other properties along the river front, and would render the navigation of vessels through the channel most difficult and dangerous, particularly in the case of steamers with tow.

And whereas the Detroit & Windsor Ferry Co., who carry to Amherstburg and Bois Blanc upward of 300,000 passengers annually, in addition to other passenger and freight traffic, and the marine fueling and wrecking interests at this town are all obliged to use the Canadian Channel exclusively.

And whereas the residents of Amherstburg believe that the construction of the proposed dam to the head of Bois Blanc Island will prevent the sewerage from up-river points and the drainage of the River Canard, which enters the Detroit River about 4 miles above Amherstburg, from following its natural course, which is in part at least to the west of Bois Blanc, and will instead divert it through the Canadian Channel and to the intake of the town waterworks plant, thereby endangering the health of the population of the three municipalities which obtain their water supply therefrom.

And whereas this said flow of sewerage and drainage is assuredly diverted from the Canadian Channel aforesaid at such winter seasons when a windrow of ice forms from the head of Bois Blanc Island northeastward across said channel to the main shore above the town, which windrow sometimes packs practically solid to the bottom of the river.

And whereas notwithstanding the numerous excavations made in the Detroit River from time to time since 1872, which have increased the depth of water through the Canadian Channel from 12 to 13 feet at that time to 23 feet for a width of 600 feet, there has not been any apparent lowering of the water level, but on the contrary since these excavations of the channel the water levels have been higher than for several years prior thereto.

And whereas the opening of the new Livingstone Channel has not perceptibly lowered the stage of the water above.
And whereas the work of enlarging the new Livingstone Channel to a uniform width of 450 feet throughout its entire length is only partially completed, your petitioners humbly pray that no action be taken with respect to the proposed dam, which will permanently destroy the scenic beauty of this locality and work irreparable injury to the town of Amherstburg until the work shall have been completed and its effect on the water levels and the current positively ascertained.

And your petitioners will ever pray.

W. Fred Park, M. B.,
Mayor of Amherstburg.

NOTICE OF SPECIAL MEETING.

The commission being informed that both Governments and all others interested in the investigation of the subject matter of the reference would be ready to proceed about February 15, 1913, a special meeting was called for the 17th of that month to meet in the Federal Building at the city of Detroit. Due notice of this meeting was published in the cities and towns on the Detroit River, both in Canada and the United States, and pursuant thereto the commission met at Detroit on the date named and remained in session for three days, or until February 20, investigating questions involved in the reference.

APPEARANCES.

Mr. Reeves T. Strickland, assistant to the Attorney General, appeared alone on behalf of the United States.

Mr. R. W. White, K. C., and Mr. Charles S. MacInnes, K. C., appeared on behalf of the Dominion of Canada.

Other parties appeared as follows:

Mr. G. Lynch-Staunton, K. C., for the Province of Ontario;
Mr. F. A. Hough for the town of Amherstburg;
Mr. A. R. Bartlett for the Windsor & Detroit Ferry Co.;
Mr. F. D. Davis for the county of Essex in the Province of Ontario;
Mr. J. H. Rodd for the township of Malden in the Province of Ontario; and
Mr. Frances King for the Dominion Marine Association and on behalf of the shipping interests of Canada.

PROCEEDINGS AT SESSION.

On the opening of the session, Mr. White, K. C., on behalf of Canada, submitted a memorandum as follows:

MEMORANDUM RE LIVINGSTONE CHANNEL.

The Canadian Government has been advised that the Government of the Province of Ontario is to be represented by counsel at this hearing, and as it is the only Province of Canada bordering on the Great Lakes and Lake of the Woods systems its interests and rights are of paramount importance, and no doubt will receive the consideration they deserve.
The Canadian Government is also aware that representations have been made to the international joint commission, in opposition to the proposed structure, by citizens of Amherstburg and vicinity. It understands that these citizens are represented by counsel, and it feels confident that the commission will give the fullest consideration to their claims.

The interest of the Canadian people in the development and improvement of the international waterway is evidenced by the fact that in the building and improvement of the canal system and in river, lake, and harbor improvements upon this system Canada has already expended not less than the sum of $319,454,320, and further large expenditures for like purposes are now in contemplation.

The Canadian Government is thus in complete sympathy with the desire of the Government of the United States to improve in every possible way the navigation of international waters from Lake Superior eastward, including that portion of the Detroit River now before the commission for consideration; and in this, as in all other matters of common concern, it wishes to cooperate to the fullest extent possible with the Government of the United States.

It is firmly convinced, however, that a piecemeal policy in the development of navigation and other mutual interests on boundary waters is not to the ultimate advantage of the two countries; that until reports are received from investigations into the proposal to construct a submerged weir in the Niagara River for the purpose of raising the level of Lake Erie 5 or more inches, as well as from other investigations, or while diversions from Lake Michigan, even though unauthorized, are seriously affecting the levels of the Great Lakes, the connecting waterways, and the St. Lawrence River, it would appear undesirable at the present time for either Government to commit itself to a policy of compensatory works at individual points in the interested waters until some definite conclusion is reached as to the extent to which diversions from Lake Michigan are to take place.

It appears from the report of the Chief of Engineers, United States Army, dated the 23d of January, 1911, that the diversion from Lake Michigan into Chicago then amounted to about 7,000 cubic feet per second, or 3,000 cubic feet per second in excess of the permit of the Secretary of War. It is understood that this large diversion still continues and is even believed to be exceeded.

The situation developed is as follows:

**CHICAGO'S DIVERSION FROM LAKE MICHIGAN.**

<table>
<thead>
<tr>
<th>Amount of water extracted.</th>
<th>Effect on depth at—</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Head of Livingstone Channel.</td>
</tr>
<tr>
<td>3,000 c. f. s.</td>
<td>Decrease from 1.20 to 1.60 inches.</td>
</tr>
<tr>
<td>8,000 c. f. s.</td>
<td>Decrease from 3.27 to 4.30 inches.</td>
</tr>
</tbody>
</table>

**COMPENSATING WORKS ON DETROIT RIVER.**

<table>
<thead>
<tr>
<th>Character of work.</th>
<th>Effect in depth at—</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Head of Livingstone Channel.</td>
</tr>
<tr>
<td>Construction of Livingstone Channel</td>
<td>Decrease, 1.44 inches.</td>
</tr>
<tr>
<td>Construction of Bois Blanc Dike with 300-foot opening</td>
<td>Increase, 2.38 inches.</td>
</tr>
<tr>
<td>Advantage gained by new channel and dike</td>
<td>Increase, 1.44 inches.</td>
</tr>
</tbody>
</table>
REPORT ON THE LIVINGSTONE CHANNEL.

It will be observed from the above tables that the proposed compensatory works will just about restore to the stream at the head of Livingstone Channel and will not restore to Lake St. Clair what was lost by deepening and an excess diversion of even 3,000 c. f. s.

It therefore appears that "the desirability of the improvements," as expressed in the reference is, under the existing conditions, open to serious question, unless the wider problem is also to receive necessary attention without delay; and the Canadian Government invites the consideration of the commission to this phase of the matter.

In presenting the foregoing views, the Canadian Government desires to emphasize the fact that it is actuated solely by a sincere desire for the development of the entire system of waterways in the best interests of the people of the two countries, and though Canada, in this particular case, is not called upon to bear any part of the cost of the proposed work, it must be remembered that there are other vital points in these international waters, the efficiency of which—now seriously impaired by what appears to be an uncontrolled depletion elsewhere—can not be improved by works of a compensatory character, so as to yield the greatest results while the present situation at Chicago exists.

W. R. WHITE,
C. S. MACINNES,
Counsel for the Government of Canada.

FEBRUARY 17, 1913.

HEARING OF WITNESSES.

The following witnesses were then called, sworn, and examined:


William J. Stewart, chief of the hydrographic survey of Canada, and Lieut. Col. Henry J. Lamb, district engineer of the department of public works of Canada, on behalf of the Dominion of Canada;

W. H. Wright, George R. Pearson, and John Williams, on behalf of the Dominion Marine Association; and

P. J. Nicholson, Walter E. Campbell, Frederick Trotter, John J. Bemstead, Dr. Charles A. Hodgetts, Edward J. Patton, Dr. W. Fred Park, F. A. Dallya, and Dr. John Amyot, on behalf of the town of Amherstburg.

SYNOPSIS OF EVIDENCE.

(a) The Livingstone Channel.

This channel, about 11 miles in length, constructed by the Government of the United States at a cost of about $11,000,000, departs from the main channel of the stream a short distance above the Limekiln ridge of rock and extends in a direct course some 5 miles down the Detroit River to near Bar Point, when it becomes part of the main channel and continues on the same course down into Lake Erie.
REPORT ON THE LIVINGSTONE CHANNEL.

This project, a modification of others and adopted in 1907, contemplated the width of 300 feet over the 5 miles, when the width of the main channel on into Lake Erie was to be 800 feet.

The upper section, some 5,800 feet in length, through the Limekiln ridge, was excavated in the dry. In 1910, while the cofferdam was in place and the work in progress, a board of United States Army engineers recommended that the channel through the rock within the cofferdam should be widened to 450 feet. It was then believed that the dredging of this channel, and especially the additional width of 150 feet in the cofferdam section, would appreciably lower the water in the river immediately above the entrance to the Livingstone Channel and in a lesser degree extending up into Lake St. Clair. The board therefore recommended the construction of a dike from the east side of the lower end of the cofferdam running southeasterly about 3,000 feet to the north end of Bois Blanc Island. Two-thirds of the proposed dike, it is estimated, would be in Canadian territory.

In addition to compensating for the supposed increased flow from the river and lake above on account of the construction of the Livingstone Channel, the board also at that time anticipated the existence of cross currents from the Amherstburg Channel across the Livingstone Channel below the cofferdam, and reported that the construction of the proposed dike would eliminate these cross currents in the Livingstone Channel and thus safeguard the interests of navigation.

(b) Commerce on the Great Lakes.

The importance of the Detroit River and of the Great Lakes in the commerce of the United States and Canada can not be overestimated. Its growth and development during the last few years have been enormous. Except that portion which passes through the Straits of Mackinac down Lake Michigan, the whole of the east or down bound commerce of the Great Lakes will in the future pass through the Livingstone Channel.

The lock canals at Sault Ste. Marie have been in commission for 57 years. During that period the annual traffic has increased from 14,503 tons to 72,472,676 tons in the year 1912, of which 32,824,815 tons passed through the United States canal at Sault Ste. Marie and 39,647,861 tons through the Canadian canal. This tonnage is 10,109,458 tons greater than in 1910, the previous high record year, and the increase in the two years almost as much as the entire traffic passing through the Sault Ste. Marie canals in 1892, only 20 years ago.

In the year 1912 approximately 95,000,000 tons of freight, valued at more than $800,000,000 and carried by 26,465 vessels, passed up and down the Detroit River. This was an average of 1 vessel every 13½ minutes during the entire season of navigation—242 days—and...
an average of freight traffic every minute, night and day, during that period of 272 tons. This traffic, as it appeared in the evidence, is more than three times the freight which passed through the Suez Canal in 1911, where the season of navigation extends through the entire year.

(c) Opening of the Livingstone Channel.

In the autumn of 1912 the Livingstone Channel—450 feet wide within the cofferdam and 300 feet below—was opened for navigation. It was then found from actual experience that the lowering of the waters above the channel was not sufficient to require compensatory works of any kind so long as the opening out and through the cofferdam and the channel below is restricted to 300 feet in width.

The testimony of all the engineers agreed in that respect. Lieut. Col. Patrick stated—

After we took away the dam (i.e., made the opening through the cofferdam) we had a number of observations made, and we show positively that the condition of flow in the channel has been very nearly restored to just what it was before any work was done there at all.

The evidence regarding the effect of cross currents on vessels passing down the Livingstone Channel was conflicting. It is quite evident that these cross currents do exist affecting about 2,000 feet of the channel and through which vessels plying 8 miles per hour would pass in about two minutes. That section of the channel is entered about one-half of a mile below the cofferdam.

Two groups of masters of vessels testified as to these cross currents, one in the service of the Lake Carriers' Association; the other, the Dominion Marine Association. Those in the employ of the former, while admitting that they took their vessels down the channel safely from one to three times, felt they were incurring considerable risk. The other group of masters having a like experience did not appear to regard the situation as requiring more than additional caution on the part of the navigator.

They all appeared to be dissatisfied with the lighting of the channel, which it is understood is being changed. Every vessel—some 1,227—passed down safely from the date of the opening of the channel on October 19 to the close of navigation in December last.

(d) Effect on lake levels of Chicago diversion.

Evidence was offered in support of the claim of the navigation interests of Canada and the claims of the Dominion Government that the level of the Detroit River, Lake St. Clair, Lake Huron, and Lake Michigan has been lowered by the diversion of the waters of Lake Michigan through the drainage canal, also that the United States has authorized the city of Chicago to draw from Lake Michigan,
through this drainage canal, water to the extent of 4,167 c. f. s. The evidence does not, however, show conclusively the exact amount of water so diverted, but it would appear that the amount diverted exceeds the amount of the permit, and is not less than 7,000 c. f. s. Upon this testimony counsel for Canada and the navigation interests of Canada contended that compensatory works in the Detroit River were not at this time necessary, and would not be necessary, even if the Livingstone Channel were ultimately widened to 450 feet, provided the alleged unauthorized diversion of the water of Lake Michigan, through the drainage canal, was terminated.

In this connection counsel for Canada offered in evidence:

(a) The report of the Chief of Engineers of the United States to the Secretary of War, dated February 28, 1912, as to the sanitary district's diversion of water from Lake Michigan through the Chicago River; and

(b) The decision of the Secretary of War, dated January 13, 1912, refusing the increase of the Chicago permit from 4,167 to 10,000 c. f. s.

In presenting these documents counsel called special attention to the following statements therein:

(1) In the report of the Chief of Engineers it is stated:

And any loss of water by such diversion (at Chicago) will make necessary further expensive construction works, or dams, or dredging in Lake St. Clair, Detroit and St. Lawrence Rivers in order to maintain channel depths—

And (2) the reference of the Secretary of War to the report of the president of the Chicago Sanitary District for 1911, wherein it is claimed its water supply is not to be limited to 10,000 c. f. s., and (3) the statement of the Secretary of War that the withdrawal of the increased volume at Chicago—

would create substantial injury in all the American harbors of the Great Lakes and in the St. Marys, St. Clair, and Detroit Rivers. It would produce equal injury in Canadian harbors on the Great Lakes, and a still greater injury on the lower St. Lawrence, the Canadian officials claiming a probable lowering effect of 12 inches at Montreal at low water—

And elsewhere—

every drop of water taken out of Chicago necessarily tends to nullify costly improvements made under direct authority of Congress throughout the Great Lakes, and a withdrawal of the amount now applied for would nullify such expenditures to the amount of many millions of dollars, as well as inflict an even greater loss upon the navigation interests using such waters.

(c) Grounds of local opposition.

Other contentions in opposition to the construction of the proposed dike were:

1. That it would cause a material increase in the volume of the water in the Amherstburg Channel of the Detroit River, which flows past
the town of Amherstburg, as well as an increase in the velocity of its current; and

2. That the waters passing down that channel are contaminated with the sewage of Detroit, to the injury of the health of the people of Amherstburg and those below on the Canadian side of the Detroit River.

From the testimony of the engineers it appeared that the increase in the flow of water through the Amherstburg Channel in consequence of the construction of the proposed dike would vary from 13,000 to 17,000 c. f. s., and that the increase in the velocity of the current in the channel would vary from three-tenths to five-tenths of a mile per hour. It was claimed that the effect of this increased flow and increased velocity would cause a greater amount of ice in the Detroit River and the lakes above to be carried past Amherstburg to the injury of the property of its people and their commercial interests; that it would force a larger amount of polluted water into the Amherstburg Channel, thereby endangering the health of the people of Amherstburg which draws its water supply, both for sanitary and domestic purposes, from that channel; and that it would also materially interfere with the local navigation on the river detrimentally affecting the business of summer resorts in that vicinity, notwithstanding the fact that the plan for the proposed dike provides an opening of 300 feet intended for the benefit of local interests.

In connection with the evidence regarding the pollution of the stream four experts appeared, two from the board of health of the Province of Ontario. While there is certainly running through the testimony of all the idea that Detroit sewage is endangering the health of the citizens of Amherstburg, two only make a direct statement to that effect.

The counsel representing the Province of Ontario took the position that pollution is now passing across the boundary into Canadian waters, and that the proposed dike would divert a larger volume of water into the Amherstburg Channel; that in consequence thereof such a structure would be illegal—contrary to the terms of the treaty, which provides that boundary waters shall not be polluted on the one side to the injury of health or property on the other.

HEARINGS AT WASHINGTON.

In view of the request of Col. Livingstone, at the conclusion of the Detroit hearings, to be allowed time to file some additional testimony, and the necessity of giving the various counsel time to reply, the commission was unable to take up the question of decision and report upon the reference until its regular semiannual meeting held in the city of Washington on April 1, 1913.
REPORT ON THE LIVINGSTONE CHANNEL.

From a careful consideration of the evidence it appeared that the actual opening of the Livingstone Channel, while restricted to its present width of 300 feet below the cofferdam, has not appreciably affected the level of the waters above the channel, and that the proposed dike would only serve to prevent the cross currents in the Livingstone Channel. The evidence further tended to show that the dike was most objectionable to Canadian interests, fearing serious damage therefrom both to health and property.

Several other plans for reducing these cross currents were considered by the commission, whereupon, on April 3, 1913, Lieut. Col. Mason M. Patrick, of the Corps of Engineers, United States Army, in charge of the Detroit district, and Mr. William J. Stewart, chief of the hydrographic survey of the Dominion of Canada, were called and reexamined for the purpose of ascertaining if in their judgment it would be practicable to construct any other dike or protective works that would eliminate as far as possible the cross currents in Livingstone Channel and with least injury to interests along the Amherstburg Channel. Upon this subject Lieut. Col. Patrick, for the United States, testified as follows:

Col. Patrick. There is, I think, substantial agreement that with the Livingstone Channel opened as it is at present there is no special necessity for any compensatory works. I think it is equally well established that if it be opened to a greater width, compensating works will be necessary; but, dealing with the question as it exists now and with the present opening in this channel, the only thing to take care of, so far as navigation interests are concerned, is this objectionable cross current below the lower end of the portion of work that was done in the dry. I am thoroughly convinced that that cross current is objectionable, and that it is a wise measure to take some means to mitigate its effect, if it cannot be entirely eliminated. From a navigation standpoint, from an engineering standpoint, and from an economical standpoint the best of all solutions is the dike proposed from the southwest corner of the cofferdam to Bois Blanc Island. There is a second way in which that cross current can be absolutely eliminated; that is, by running a dike parallel to the channel down along its eastern side. That would concentrate the current above the head of Bois Blanc Island, and would wash it away unless it was protected by a heavy revetment. It was suggested at the hearings in Detroit that some good might be done by placing a dike along the west side of the channel. I had not at that time given any great amount of consideration to such a palliative measure, because I did not think it would accomplish its purpose in its entirety. Since that time I have thought of it again and have talked the matter over with the Chief of Engineers. From the chart it is apparent that on the west side of the channel, just about where this current crosses it, there is a considerable hole or deep place in the river itself, and I believe that the draw of this current across the channel is made possible or results from the presence of that deeper area on the west side. So I think that if a wall or dike be built along the west side of the channel, beginning at a point below where the boats cross from Sugar Island to Amherstburg and running down a few thousand feet, it will be a palliative measure which might be sufficient to counteract the worst effects of this current. That is, my subsequent study of the matter has led me to that belief. In other words, there are those three ways: The proposed dike
from the cofferdam to Bois Blanc Island; the retaining wall running down on
the east side; and this third proposition down the west side. As to the ques-
tion of their economy, my estimate, which I promised to submit to the com-
mission, by the way, and must apologize to the commission for having for-
gotten to do while in Detroit, I have since made up. The cost of running the
dam over to Bois Blanc Island will be about $33,000.

Now, as you permitted me to go a little further, there is another thing which
I think might form a part of a recommendation if the commission sees fit to so
consider it. There was considerable testimony showing that a great deal of the
difficulty in this part of the river was due to the difficulty of entering the Liv-
ingstone Channel at its northern end. While that is not specifically referred to
your commission in this reference, if anything is done to mitigate the state of
affairs that now exists there I assume it would come before your commission.
You would have to recommend the excavation that would be necessary in
Canadian or American waters. At the northern end of this channel, if a portion
of the rocky reef to the westward of the entrance can be removed and also some
of the shoals on the eastern side can be removed so that the shipping can get
into it better, there will be a great advantage to shipping in that part of the
river.

Mr. Powell. That is, they want a straight course for the entrance?

Col. Patrick. They want rather a curved course for the entrance. If they
can take the angle out and come on a gentle direction rather than an abrupt one,
it would aid them greatly.

Mr. Casgrain. Would that be very expensive?

Col. Patrick. No, sir. A portion that would be removed lies in Canadian
waters. I am not sure that all of it does not lie in Canadian waters. The
boundary line goes right across that portion of the channel excavated in the dry.

Mr. Turner. Could not that be done by the United States without any further
action on the part of Canada on the original arrangement under which this
cofferdam was excavated?

Col. Patrick. There has been considerable question as to the United States
doing this under that authorization, and I simply hoped that your commission
might be able to recommend that this be done and settle the matter once for all.
If the recommendation of Canada is needed, let us get their recommendation
for it.

Mr. Turner. This reference to us contemplates a channel 450 feet wide. As I
understand it, the money has been appropriated for that.

Col. Patrick. No, sir; I have to differ with you there. The money was appro-
priated for widening this narrow portion of the channel to 450 feet and for
building this dam.

Mr. Turner. There has been no appropriation for the entire channel?

Col. Patrick. Not for widening the channel for its entire length; no, sir. It
is from the end of the cofferdam down to the end of the channel—down to
where it was dredged. No appropriation has been made for widening that to
any width greater than 300 feet, and there has been no recommendation on
the part of the engineers as yet, but when the board recommended this dam
up here they had in mind that the time would come when that would be neces-
sary. The time has not arrived, however.

Mr. Street. There is just one more question, Col. Patrick, and I hardly
know how to put it, but I want to know, in substance, if the commission should
adopt the third solution, namely, the dike on the west side, whether, in your
Judgment, the navigation interests would thereby be satisfactorily protected against the cross currents?

Col. Patrick. I have answered that question, sir, as best I could before. I hope that they will be satisfactorily protected, and I think there is reason to believe that they would be, but until it is actually done, I do not think you can answer that question categorically yes or no.

Mr. Streeter. Well, Col. Patrick, you must understand that if that is done, if that conclusion should be reached by the commission, they would have to depend largely on the impression which you give as to the satisfactory results.

Col. Patrick. I am aware of that, and am trying to answer as best I can. I say that subsequent study has impressed me with the belief that such a dike will materially modify the velocity of that cross current or danger from that cross current. I do not think it the best solution, but I think it a solution which in all probability will be a satisfactory one. That is the best I can say.

Mr. Streeter. Col. Patrick, I want to ask you one more question. Do I understand that you have conferred with the Chief of Engineers, Gen. Bixby, about this third solution?

Col. Patrick. Yes, sir; I did.

Mr. Streeter. May I ask if he agreed with your view that this solution will probably be satisfactory so far as navigation interests are concerned?

Col. Patrick. I feel quite sure that I am warranted in saying that the Chief of Engineers coincides with my views.

Attached hereto is a map of a section of the Detroit River showing the three dikes described by Lieut. Col. Patrick. That covered by the reference to the commission is shown as No. 1. The other two are numbered in the order named by Col. Patrick.

The map also shows the portion of the rocky reef which Col. Patrick suggests should be widened in order to facilitate the entrance of vessels into the Livingstone Channel and which he estimated would cost $200,000. Col. Patrick was of opinion that a considerable portion of the area of the proposed widening is in Canadian waters.

Mr. Stewart adhered to his opinion expressed at Detroit, that the cross currents are not as objectionable as some appeared to think, but that the dike No. 3 would materially decrease their effect on vessels passing down Livingstone Channel, and consequently it would be "a great improvement."

Regarding the proposed widening at the head of the channel, Mr. Stewart said that it is "highly desirable," and, in so far as concerns the excavation of that portion of it as is in Canada, "I am prepared to recommend to the Canadian Government to allow it to be done."

At the conclusion of the foregoing testimony, and after affording counsel for the United States and Canada an opportunity to be heard, the hearings upon the reference were finally closed.

CONCLUSIONS.

The commission, after due consideration of all the evidence, begs leave to submit to the Governments of the United States and Canada its unanimous conclusions thereon, and its recommendations therein,
together with all the testimony taken at the hearings upon the reference, as follows:

1. That "under all the circumstances and conditions surrounding the navigation and other uses of the Livingstone and other channels in the Detroit River on either side of the international boundary" we do not deem "the erection of any dike or other compensatory work necessary or desirable for the improvement or safety of navigation," considered from the standpoint of compensation alone, as the evidence shows that the level of the water above the Livingstone Channel has not been appreciably affected by its construction.

2. Further answering question 1, we do deem the erection of a dike at some point in the vicinity of Livingstone Channel necessary, or at least desirable, for the improvement and safety of navigation, considered from the standpoint of the cross currents before referred to; but in view of the possible injury to local interests on the Canadian side of the river, and as the evidence makes it clear that dike No. 3 on the west side of the channel can be constructed at practically the same cost as the proposed dike No. 1, and which we believe will so lessen the effect of these cross currents as to meet the needs of navigation, the commission concludes that dike No. 1 should not be constructed.

3. We are satisfied the erection of a dike, to prevent or materially lessen the effect of the cross currents in the Livingstone Channel, is very desirable in the interests of navigation in said channel. In view, however, of all the testimony of the engineers of both Governments, acquiesced in by the Chief of Engineers, United States Army, as testified to by Col. Patrick, we find that a dike built on the west side and parallel with the Livingstone Channel below the cofferdam, at the point where the cross currents now interfere with navigation in the Livingstone Channel, will so mitigate or reduce the velocity of the cross currents as to reasonably protect the interests of navigation, and that such a dike, while safeguarding the interests of navigation, will not affect the flow or the velocity of the current in the Amherstburg Channel.

4. Therefore, specifically answering question No. 2, we find that the dike proposed by the United States should not be constructed, but that a dike should be built on the west side and parallel with the Livingstone Channel as above described.

5. In view of the conclusion of the commission that compensation under the circumstances is not necessary, the commission does not consider it is called upon to discuss or express any opinion as to the extent diverted water at Chicago might affect the flow in the Detroit River, nor is it necessary to consider its authority, under the terms of the reference, to report upon the same.
6. For similar reasons and because of the conclusions of the commission that the construction of dike No. 3 will not increase either the flow or current of the river at Amherstburg, the commission does not deem it necessary to review the argument of counsel for the Province of Ontario on the question of whether or not the effect of the construction of dike No. 1 upon the flow and current of the Amherstburg Channel would be a violation of the provision of the treaty between the United States and Great Britain of May 5, 1910, in respect to the pollution of boundary waters on one side of the line to the injury of health and property upon the other.

RECOMMENDATIONS.

The commission therefore recommends to the Governments of the United States and Canada—

The construction of a dike to the west of and parallel with the Livingstone Channel, and extending downstream about 4,400 feet from a point below the channel used by boats crossing between Sugar Island and Amherstburg in the Detroit River, said point being about 2,800 feet below the lower end of the cofferdam.

It would appear that about 1,200 feet of the upper end of said dike, if constructed, would be on the United States side of the boundary; the remainder thereof would be located on the Canadian side.

While the reference does not call for an investigation of anything save and except the questions as to the necessity for certain dikes and compensating works in the Detroit River for "the improvement and safety of navigation," yet in view of the importance of the matter and of the suggestions of Lieut. Col. Patrick, Corps of Engineers, United States Army, in charge of the Detroit district, to the effect that certain excavations above the entrance to the Livingstone Channel would greatly improve the navigation of said river and is being urged by that interest, and of the fact that Mr. William J. Stewart, chief of the hydrographic survey of Canada, agrees with Lieut. Col. Patrick in this respect, and suggested that so far as the excavation necessary for this purpose would have to be done on the Canadian side of the boundary, he would recommend that the consent of Canada be given for that purpose, the commission concludes, and feels justified in recommending, although technically not within the terms of the reference, the excavation of that wedge-shaped strip adjoining the channel entering the Livingstone Channel on its west side extending about 2,500 feet upstream from the entrance to the channel or the upper end of the cofferdam indicated on the map hereto attached, as well as the dredging of certain shoals on the east
side of said channel and opposite the above-mentioned wedge-shaped strip as proposed and recommended by the engineer officers.

Dated at Washington this 8th day of April, 1913.

TH. CHASE CASGRAIN.
JAMES A. TAWNEY.
HENRY A. POWELL.
FRANK S. STREETER.
C. A. MAGRATH.
GEORGE TURNER.