INTERNATIONAL JOINT COMMISSION

SPECIAL INTERIM REPORT

ON

REGULATION OF LAKE SUPERIOR OUTFLOWS TO PROVIDE RELIEF FROM HIGH WATER LEVELS ON THE LOWER GREAT LAKES

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INTRODUCTION

In order to determine whether measures within the Great Lakes Basin could be taken in the public interest to further regulate the levels of the Great Lakes and their connecting waters so as to reduce the extremes of stage which had been experienced, and for other beneficial effects, the Governments of Canada and the United States in 1964 referred the matter to the International Joint Commission for investigation and report pursuant to Article IX of the Boundary Waters Treaty. The terms of reference are attached hereto.

Lakes Superior and Ontario are the only Great Lakes presently under regulation. The outflows from the two Lakes are regulated in accordance with the Commission's Orders of Approval dated May 26 and 27, 1914 and October 29, 1952 (amended July 2, 1956), respectively.

The Commission appointed the International Great Lakes Levels Board composed of highly qualified engineers in the public service of the two Governments to undertake, through appropriate agencies in Canada and the United States, the necessary investigations and studies and to advise the Commission. The Board's study has been a complex one, involving the investigation of many alternative possibilities

of lake regulation to determine what would be most practicable and in the public interest. It is now nearing completion and the Commission expects to receive the Board's final report later this year. In accordance with its usual procedure, the Commission will make the Board's report available to the public, hold public hearings and then formulate its report for submission to the two Governments in accordance with the terms of reference.

Although Great Lakes levels were very low in 1964 when the Reference was forwarded to the Commission, they returned to their average levels within a few years. In 1971 the lakes entered another period of extremely high water levels and this has been a matter of great concern to the Commission, as well as to governments and to persons in both countries affected by the high water levels. Accordingly, in a letter to the International Great Lakes Levels Board dated January 15, 1973, the Commission informed the Board that it was "considering, as a matter of urgency, the possibility of operating the control works at Sault Ste. Marie in such a way as to provide relief for the lower Great Lakes and at the same time, maintain satisfactory conditions on Lake Superior". The Board was requested to report its "interim findings and conclusions with respect to possible modified operations at Sault Ste. Marie". The Board's "Interim Report on Lakes Superior and Ontario Regulation," dated March 15, 1973, was submitted to the Commission in response to this request.

Meanwhile, on January 26, 1973, the United States Government presented an emergency application, formally requesting the Commission to authorize and direct the United States "to reduce water releases for power generation through power canals or other facilities operated under the authority and jurisdiction of the United States in the St. Mary's River to the extent necessary or feasible, in the judgement of the United States, to relieve the critical high water conditions on the lower Great Lakes ....". In response to this Application and to expressions of concern on behalf of the Canadian Government, the Commission on January 30 directed the International Lake Superior Board of Control to deviate from its current regulation plan for a period of three months and further reduce Lake Superior outflows to approximately 55,000 cubic feet per second, the minimum winter outflow allowed under the regulation plan. Subsequently, this period of reduced flows was extended to June 30, 1973, to allow time for consideration by the Commission and the two Governments of the desirability and feasibility of modifying the operation of the control works to relieve conditions on the lower Great Lakes.

In accordance with its Rules of Procedure, the Commission held public hearings in Rochester on May 3, Toronto on May 4, Detroit on May 8 and Sault Ste. Marie on May 10 and a public meeting in Duluth on June 18 to obtain public reaction to the Interim Report of the International Great Lakes Levels Board.

This report presents an interim course of action based on changes in Lake Superior regulation only. Conclusions and recommendations concerning long-range possibilities will be included in the Commission's final report under the 1964 Reference.

THE NATURE OF THE PROBLEM

The physical realities which govern the levels of the Great Lakes are complex. This section describes the limits, both natural and man-made, within which interim changes in regulation are possible.

Lake System Hydrology

The water in the Great Lakes comes from the rain and snow falling on the Lakes and on the lands draining into them. A large portion of this precipitation is lost through evaporation. With their large areas, the Lakes are normally able to store the net supply with only small changes in their levels. However, the volumes of water discharged through the rivers connecting and draining the Lakes are small compared to the storage volumes of the lakes. The relation between storage volume and outflow capacity is such that, if precipitation persists above or below normal, water levels vary significantly above or below their long-term averages. The high water levels which occurred in 1951-52

and are occurring again this year are the result of persistent high precipitation. The low levels of 1964-65 occurred when precipitation persisted below normal. Because of the size of the Great Lakes and the limited discharge capacities of their outflow rivers, extreme high or low levels and flows persist for some time after the conditions which cause them have changed.

Every lake basin received above average precipitation in 1972 and this has continued into 1973. Every lake has been above its long-term average level since 1971. The cumulative effect of this above average precipitation was an all-time record supply of water to Lake Ontario in 1972 averaging 250,000 cubic feet per second and continuing above average in 1973.

During May 1973, Lake Superior was about one foot below its recorded maximum level and one foot above its long-term May level. Lakes Michigan and Huron levels were about one and one-quarter feet below their maximum recorded levels and one and three-quarters feet above their long-term May levels. Lakes St. Clair and Erie each exceeded the recorded maximum level in the order of 6 inches and were both about two and one-half feet above the average for May. Lake Ontario established a new maximum level for the month of May. This is about two and one-half feet above the average level for May and about one inch below the maximum level of record, reached in June 1952.

Lake Level Fluctuations

The levels of the Great Lakes fluctuate in three ways: over the long-term, seasonally, and for short periods. Long-term fluctuations result from persistent high or low supplies. The long-term range of levels varies from 3.8 feet on Lake Superior to 6.6 feet on Lakes Michigan-Huron and Lake Ontario. A century of record on the Great Lakes does not reveal any regular, predictable cycle. The interval between high or low levels varies widely and erratically.

Seasonal fluctuations result from the annual hydrologic cycle. The winter snow and the spring melt cause higher supplies in the spring and early summer than during the rest of the year. Seasonal fluctuations average 1.1 feet on Lake Superior and Lakes Michigan and Huron, 1.5 feet on Lake Erie, and 1.9 feet on Lake Ontario.

Short-period fluctuations result from meteorological disturbances and may last from a few hours to a few days. Wind and differences in barometric pressure cause the lake surface to tilt. Although the lake surface elevation at a particular location has changed as much as 8 feet from such causes, there was no change in the volume of water in the lake. Short-period fluctuations are superimposed on the level resulting from long-term and seasonal fluctuations.

Superimposed on all three types of fluctuations are wind-induced waves which may cause damage at any lake level but which are most damaging at high levels.

Use of the Great Lakes

The Great Lakes are used intensely by the large concentrations of people living in both the Canadian and the United States portions of the Basin. Economic activity depends heavily on the use of the Lake system for commercial navigation and the generation of hydroelectric power. Many people live on the lakeshore, and many more depend upon the Lakes for recreation, as well as for domestic water supply.

The many uses of the Lake system depend critically on the magnitudes of Lake levels and outflows. Commercial navigation depends on maintenance of adequate depths. The power entities need adequate flows to meet electric demands. Shore interests desire to avoid either extreme high levels which damage their property, or extreme low levels which interfere with their uses of the Lakes.

Over the years, people have adjusted their many uses of the Lakes to the normal range of levels and flows. They have limited flexibility to cope with extreme conditions. The extreme lows in 1964-65 brought many requests for remedial action. The extreme highs in 1951-52 and again this year have caused widespread shore damage, and again there are many pleas for help.

Existing Great Lakes Regulation

As previously noted, only two of the Great Lakes are regulated: Lake Superior and Lake Ontario. Lakes Michigan and Huron and Lake Erie are uncontrolled. The outflow from

each of the uncontrolled lakes depends upon the depth of water and the slope of the water surface prevailing in its outflow river.

Control works were built at the outlet of Lake Superior early in the century to permit the use of part of the outflow for the generation of electric power. In its 1914 Orders of Approval granting permission for this diversion of boundary waters, the Commission laid down the condition that in the future the level of Lake Superior would be maintained "as nearly as may be" between 600.5 feet and 602.0 feet IGLD. The upper limit is within 0.1 foot of the maximum monthly mean level recorded before the control works were built. It has been carefully observed ever since. The present regulation plan for Lake Superior (the 1955 Modified Rule of 1949) was formulated by the International Lake Superior Board of Control, which was established by the International Joint Commission, pursuant to the terms of the said Orders of Approval to secure the regulation of Lake Superior as set forth therein. It specifies the total outflow through the power plants, control works, and navigation locks based upon the level of Lake Superior. The "rule curve" is designed to maintain the lake level within the range prescribed in the Orders of Approval, as nearly as supply conditions permit.

Lake Ontario is regulated by means of the power facilities built on the St. Lawrence River in the 1950's. These were designed in such a way as to permit reducing the range

of stage on Lake Ontario and improving the distribution of outflows, without changing the regime to the detriment of downstream interests. The applications by the Governments of the United States and Canada for the Commission's approval were based on the premise that construction and operation of the works would not cause injury to interests downstream on the St. Lawrence. In its 1952 Order of Approval (as amended in 1956) approving the construction of power facilities in these boundary waters the International Joint Commission prescribed conditions and criteria for the regulation of Lake Ontario and the International Section of the St. Lawrence River and established the International St. Lawrence River Board of Control to assure that such conditions and criteria are complied with.

During a period of abnormally high or low supplies, Criterion (k) provides that: "In the event of supplies in excess of the supplies of the past as adjusted, the works in the International Rapids Section shall be operated to provide all possible relief to the riparian owners upstream and downstream. In the event of supplies less than the supplies of the past as adjusted, the works in the International Rapids Section shall be operated to provide all possible relief to navigation and power interests." The Order of Approval also requires operation of the works in such a manner as to provide no less protection for riparian interests downstream than would have occurred prior to construction of the project. Accordingly, in order to reduce

Lake Ontario levels, outflows from the Lake are being maintained at the highest rate possible without causing injury downstream on the St. Lawrence River. The outflow rate is significantly greater than would have occurred if the project has not been built. As a result of these record high outflows, Lake Ontario is approximately one and one-quarter foot, as of the week of June 29, lower than it would have been without regulation.

THE BOARD'S REPORT

The International Great Lakes Levels Board concluded in its interim report that small net benefits to the Great Lakes system would be achieved by a new regulation plan for Lake Superior which takes into consideration the levels of both Lake Superior and Lakes Michigan-Huron. This plan would require only minor modifications to the existing Lake Superior control works and, if authorized, could be implemented immediately to help alleviate the severe high water conditions on the lower Lakes. The plan does not involve changes in the control works or present regulation plan (1958-D) for Lake Ontario.

Evaluation of New Plan

A period of 68 years, 1900 to 1967 inclusive, was selected for the evaluation of alternative regulation plans,

in order to use the most uniformly consistent and reliable historical data available for each of the Lakes and their outlet rivers. The interim report gives the results of the hydrologic, economic, and environmental evaluations of a new plan for the regulation of Lake Superior along with an estimate of the cost of improvements necessary for safe winter operation of the control works. To summarize the hydrologic evaluation, the new plan would reduce the range of stage on all five lakes, raise all minimum levels, and lower the maximum level of Lakes Michigan and Huron. It would not significantly change the maximum levels of the other lakes, although the frequency of higher levels on Lake Superior would be increased. The range of outflows of Lake Superior would be unchanged. For all other lakes the range of flows would be stabilized by raising the minimums and reducing the maximums. The new regime of levels and flows would, on the whole, be favourable to the needs of the major Great Lakes interests. The effect of this regulation on Lake Ontario levels and flows would be negligible.

The new plan would produce net beneficial effects during the first year if it were introduced during the present period of high lake levels. It would redistribute the water in the system, produce slightly higher levels in Lake Superior and slightly lower levels in the downstream Lakes, and thereby result in benefits to some interests and detriments to others. While there would be losses during

this period to power and to Lake Superior shore property interests, the lower Lakes would receive shore property benefits of greater magnitude.

The new plan would be beneficial to navigation interests in both countries if it were operated over a long period. Except for a loss to the plants on the U.S. side of the border at Sault Ste. Marie, Michigan, the plan would also be beneficial to power interests in both countries. The shore property evaluation indicates that three-quarters of the benefits accrue from reduction of erosion and inundation. Nearly all the remainder of the shore property benefits result from an increase in the availability of recreation beaches. Over the long-term the average annual net benefit to all interests on all lakes would be $1.6 million in the United States and $0.7 million in Canada, for a total of $2.3 million. It should be noted that this annual net benefit includes losses of $120,000 to shore property on Lake Superior and energy losses of $130,000 to the power plants on the St. Mary's River.

To summarize the environmental evaluation, the small differences between the levels and flows under the new plan and under present regulation are not expected to produce any measurable change in the productivity of the aquatic community or in fishery stocks in the main basins of the Great Lakes. The Board's report indicates that any adverse effects on fishery stocks will likely occur in the littoral zones and in the outflow rivers. Low flows in the St. Mary's

Rapids and River have been identified as having an adverse impact on the local sport fishery. However, the adverse effects of such low flows could be alleviated by remedial works and changes in operational procedures. During the balance of this year, no permanent damage is expected to occur.

To permit safe operation of the control works during the winter, provision is urgently required for heating the gates to assure that they can be operated when required, for proper enclosure and lighting of the exposed working area and for motorized drive and safety covers for the manually operated gate hoist machinery. The capital cost of these permanent improvements would be about $600,000. Effective surveillance of river levels and flows under ice conditions and necessary maintenance and utilization of the said improvements would cost about $30,000 annually. The improvements and surveillance are necessary for safe winter operation under any regulation plan which involves gate movement in the winter.

HEARINGS

The Commission held hearings on the proposed changes in the regulation of Lake Superior in Rochester on May 3, Toronto on May 4, Detroit on May 8, Sault Ste. Marie on May 10 and a public meeting in Duluth on June 18. At these

hearings all interests concerned were given convenient opportunity to express their views. Public reaction to the regulation plan presented was mixed. Lake Superior residents opposed the plan because of its adverse effects on shore property and power interests as well as its possible effects on the fishery in the St. Mary's Rapids. It was claimed that regulation of Lake Superior prior to February 1, 1973, had increased the frequency of higher levels on that lake, thereby interfering with the natural formation of beaches which protect the shore from erosion. Some suggested that if a new plan is instituted which transfers some of the benefits of regulation to the lower Lakes, any upstream interests harmed thereby should receive appropriate compensation. At Duluth, a number of statements were given concerning the effects of erosion of red clay prevalent along the southwest shoreline of the Lake. Residents of Lakes Michigan, Huron, St. Clair and Erie supported the plan, recognizing that, while it would not provide the significant short term reductions in lake levels that were desired, it nevertheless would reduce the high lake levels and consequently alleviate shoreline damage. A number of Lake Ontario residents felt that the plan would provide no benefits for them and opposed its implementation. They expressed disappointment that the plan would not lower Lake Ontario high levels. They asked the Commission to assure that everything possible is being done and will be done to lower the Lake and urged the development of a plan which would lower it by one foot or more.

DISCUSSION

Based upon the information and analyses prepared by the International Great Lakes Levels Board and the testimony received at the recent public hearings, the Commission has concluded that net benefits to the Great Lakes system, albeit small, would be achieved by a new regulation plan for Lake Superior which takes into consideration the levels of both Lake Superior and Lakes Michigan-Huron. Benefits of such a plan will be derived by shore property interests on Lakes Michigan-Huron, St. Clair and Erie and on their outflow rivers. Adverse effects will be felt by shoreline property interests on Lake Superior and power interests on the St. Mary's River. Since all the lower Lakes are currently at critical levels, as has been pointed out, while Lake Superior is only slightly above its long-term mean for this time of year, such benefits and adverse effects would be more pronounced in the first year of operation. In addition, the changes in Lake Superior outflows would change the timing and magnitude of flows used for power generation downstream.

It should be noted that the regulation of Lake Superior as proposed herein would not imply any change in the conditions and criteria for regulation of Lake Ontario as set forth in the Commission's 1952 Order of Approval, as amended in 1956, nor would it prevent the invocation of Criterion (k). To provide further relief for Lake Ontario, major construction

would be required. The Commission will report to the Governments on such possibilities in its final report under the 1964 Reference.

The Commission recognizes that only preliminary estimates of the benefits and detriments of a new regulation plan for Lake Superior are available. Generally, shoreline evaluation techniques presently available are simply not sophisticated enough to fully assess the shoreline benefits and detriments. Moreover, the weather (precipitation, evaporation, storms, etc.) cannot be forecast with any precision for a sufficient period. Accordingly, the figures in this report should be viewed as a general indication of the benefits and detriments anticipated from a change in regulation.

At the Hearings, serious concern was expressed regarding the adverse effect that very low flows in the St. Mary's River have on the sports fishery, since as much as a third of the Canadian flank of the rapids may be without water under such conditions. These low flows have occurred at times under the existing regulation plan. Under the new regulation proposed in this report they would occur more frequently. While it is not expected that this would constitute a problem during the remainder of 1973 under presently foreseeable supply conditions, it would recur shortly thereafter unless preventive action is taken before that time. The Commission has asked its International Lake Superior Board of Control to study, in cooperation with

representatives of the appropriate Federal, Provincial and State agencies, the feasibility of remedial works or other measures to ensure that the crucial areas of the rapids are not dried up under low flow conditions. The Commission will take appropriate action on completion of these studies.

The Interim Report of the Board outlines a regulation plan involving a shift in benefits between Lake Superior and the lower Lakes. The plan is based on objectives and criteria which the Commission finds generally acceptable. It is recognized, however, that it may become desirable to change the plan of regulation in future, in response to changed conditions. Accordingly, the Commission has concluded that it should seek Governmental approval of the general objectives of regulation and certain essential criteria rather than approval of a specific plan to meet them.

Regulation Objective and Criteria

The Commission considers that the objective of regulation of Lake Superior outflows should be to provide benefits to interests throughout the Great Lakes system without undue detriment to Lake Superior interests. To achieve this objective, all control works in the St. Mary's River, including but not limited to the 16-gate control structure and all power canals, their head gates and their by-passes, should be operated so as to keep the levels of Lakes Superior and Michigan-Huron at the same relative position within their recorded ranges of stage and with respect to

their mean levels. Under such operation, the level of Lake Superior would be maintained, as nearly as may be, within its recorded range below elevation 602.0 feet IGLD.

In order to accomplish the foregoing, the Commission should be given authority:

1. To amend its Orders of Approval dated May 26 and May 27, 1914;
2. To prescribe the plan of regulation for Lake Superior;
3. To direct the operation of all control works, including the determination of the amount of water available for power purposes; and
4. To delegate its authority over regulation and operation to an international board appointed by the Commission, to the extent it deems appropriate.

Existing Authority of the Commission

The Commission has concluded that net benefits would likely result from the implementation of regulation of Lake Superior outflows in accordance with the above objective and criteria. However, it needs to be understood that adoption of a regulation plan for Lake Superior which takes into account the levels of Lakes Michigan-Huron constitutes a departure from the objectives and criteria prescribed in the Commission's Orders of Approval of May 26 and 27, 1914. It is the Commission's considered opinion that it cannot

adopt the new objective and criteria under the terms of these Orders of Approval, which are still in force. Moreover, in these Orders of Approval, the Commission did not retain jurisdiction to amend the Orders so as to establish new regulation objectives and criteria.

As required by Article VIII of the Boundary Waters Treaty of 1909, the 1914 Orders of Approval prescribed conditions which the Commission stated it "deems to be and requires as suitable and adequate conditions for the protection and indemnity of all interests on both sides of the international boundary". These conditions provided for the protection of Lake Superior interests from injury caused by the construction and operation of the regulatory works and the diversions of water at the outlet of Lake Superior, with regulation based essentially on the levels of that Lake. The Boundary Waters Treaty does not authorize the Commission to approve actions which would cause damage to any interests, unless it requires that suitable provision be made for protection and indemnity.

The new regulation plan discussed in this report constitutes affirmative action to balance the storage between Lake Superior and Lakes Michigan-Huron for the benefit of interests along the lower Lakes. It is the Commission's view that, since interests may be harmed by this change in regulation, the Governments ought to address themselves to the measures that will be required for adequate protection or indemnity of these interests. The Board has estimated

that potential damage to Lake Superior interests resulting from the first year of operations could be as much as $5 million to shoreline interests on Lake Superior and $0.4 million to power in the St. Mary's River. It should be emphasized that these are estimates which will vary according to the net supplies to the Basin and the occurrence of storms in the Basin during the next year.

As mentioned earlier, the Commission has, since January 30, 1973, directed the Lake Superior Board of Control to deviate from its regulation plan and to limit the outflow from Lake Superior to 55,000 cfs, an amount substantially below that which otherwise would have been discharged. The Commission's present direction to the Board will terminate on June 30, 1973.

The Commission considers that this emergency action, which it undertook in response to the request of the United States Government and the expressions of concern of the Canadian Government, has had a net beneficial effect to date and in addition has been consistent with the proposed regulation objective and criteria set forth above. Unless otherwise instructed by the Governments, the Commission intends, following June 30, to continue on a temporary basis a course of action consistent with the said regulation objective and criteria. As soon as the emergency situation eases downstream or if Lake Superior conditions so require, the Commission will find it necessary to revert to the 1955 Modified Rule of 1949, unless further instructions have been

received from the Governments. Accordingly, the Governments are urged to take action, at the earliest possible date, on the recommendations set forth hereinafter.

RECOMMENDATIONS

1. The Commission recommends that the Government of the United States and the Government of Canada approve the regulation objective and criteria set forth herein on pages 17 and 18 and jointly grant to the International Joint Commission specific authority to adopt them and implement regulation in accordance therewith, notwithstanding any inconsistent provisions of the Orders of Approval dated May 26 and 27, 1914; to the extent that the said Orders of Approval are not inconsistent with such objective and criteria, those Orders to remain in full force and effect until amended by the Commission.

2. In order to accomplish regulation in accordance with the preceding recommendations, the Commission recommends that the two Governments jointly grant to it specific authority:

   (1) To amend its Orders of Approval dated May 26 and May 27, 1914;

   (2) To prescribe the plan of regulation for Lake Superior;

(3) To direct the operation of all control works in the St. Mary's River, including the determination of the amount of water available for power purposes; and

(4) To delegate its authority over regulation and operation to an international board appointed by the Commission, to the extent it deems appropriate.

If so authorized by the Governments, the Commission intends to proceed forthwith to amendment of the said Orders of Approval.

3. Recognizing the intent of the Boundary Waters Treaty to assure suitable and adequate protection and indemnity for all interests which may be injured by the use, obstruction, or diversion of boundary waters, the Commission recommends that the Government of Canada and the Government of the United States make provision for the disposition of claims for physical injury or damage to persons or property occurring in their respective territories and resulting from the maintenance and operation of the existing control works in the St. Mary's River pursuant to the said objective and criteria, and for the satisfaction of such claims as are valid.

4. The Commission recommends that, in order to permit safe operation of the existing control works on the St. Mary's River under winter conditions, the improvements described herein on page 13 be undertaken without delay. The International Great Lakes Levels Board has estimated

the capital cost of such improvements to be in the order of $600,000 and the annual operation and maintenance costs to be about $30,000. These improvements are urgently required whether or not a new regulation plan is implemented.

Signed this 28th day of June, 1973, as the International Joint Commission's Special Interim Report on regulation of Lake Superior outflows to provide relief from high water levels on the lower Great Lakes.

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