US Army Corps
of Engineers
North Central Division

GREAT LAKES LEVELS

Update Letter No. 67 February 4, 1991

Commercial Navigation on Great Lakes-St. Lawrence

DESCRIPTION

The Great Lakes and their connecting channels and canals form a water highway 2,342 miles long from the heart of the North American continent to the mouth of the St. Lawrence River. Of this, 1,270 miles are within the Great Lakes and the rest are along the St. Lawrence River. The major obstacles which were overcome to make a continuous navigation system are the 19-foot drop at the St. Marys River at the outlet of Lake Superior, the 326-foot drop over the Niagara escarpment, and the 245-foot drop between Lake Ontario and the Atlantic Ocean (Figure 1 and 2).

The Great Lakes-St. Lawrence Seaway System and the Mississippi River Inland Waterway System are interconnected at the south end of Lake Michigan. The latter system consists of 5,000 miles of navigable shallow draft channels and provides barge transportation from the Gulf of Mexico to the north central region of the U.S. The New York State Barge Canal provides a shallow draft system between the Great Lakes (Niagara River) and the east coast ports via the Hudson River. The shallow draft Richelieu-Champlain Waterway System connects the Hudson and St. Lawrence Rivers downstream of Montreal, Quebec.

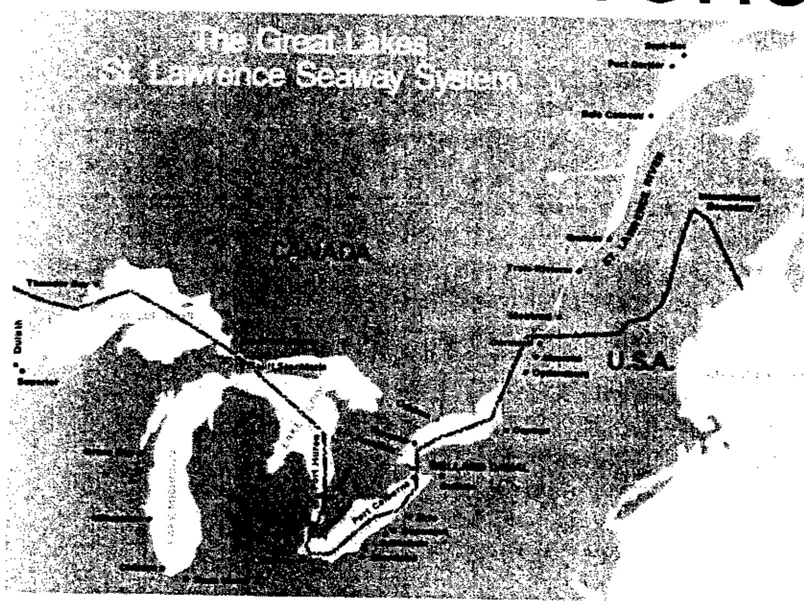

Figure 1 Great Lakes-St. Lawrence River System

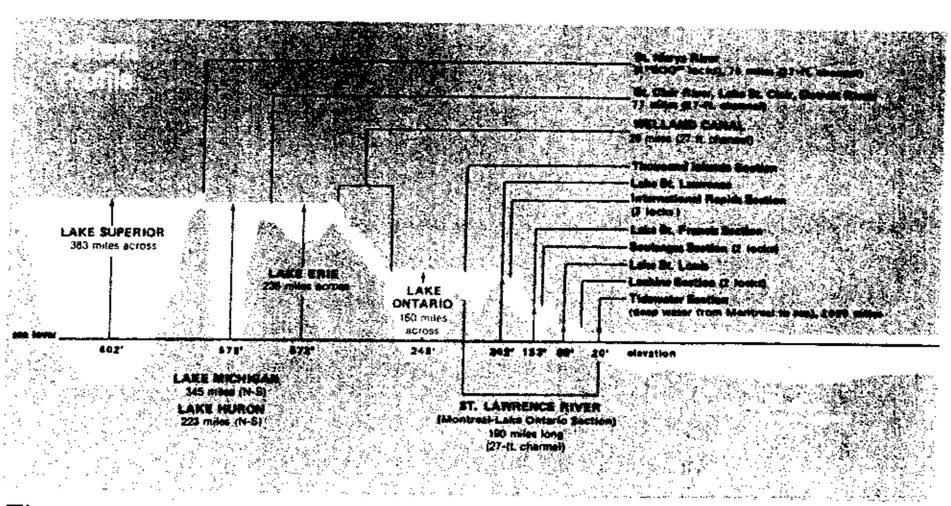

Figure 2 System profile

HISTORY

Long before the arrival of European settlers in North America, the early navigator Jacques Cartier encountered the obstacles at Lachine Rapids at Montreal, Quebec in 1534. Westward migration and its supporting navigation

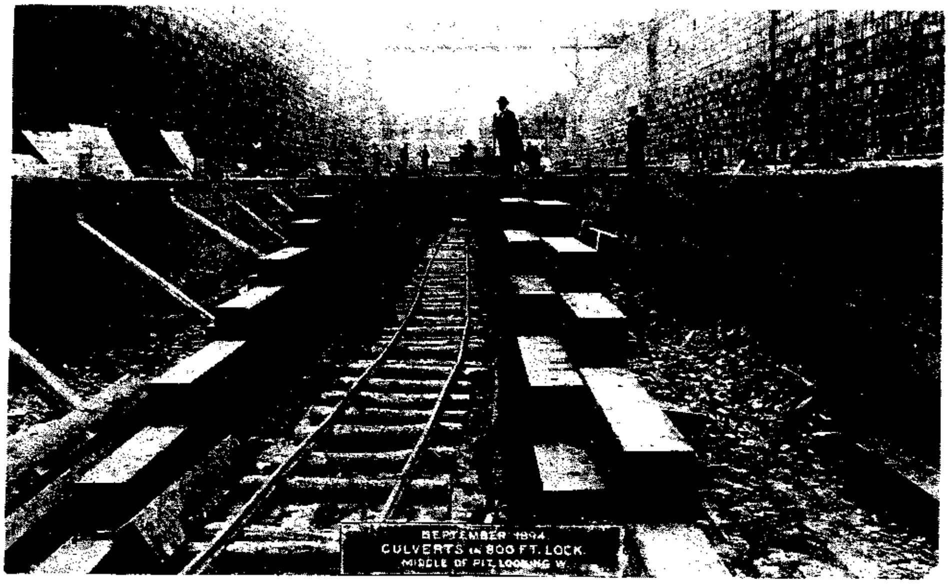

Figure 3 Old Poe Lock under construction (1894)

followed the water courses. By the late 1700s, Great Britain built the first locks and small boat canals to bypass the rapids on the St. Lawrence and St. Marys Rivers. The rapid growth of waterborne commerce between the midwest and both Europe and the Atlantic seaboard required innovative and continuous development of waterways in the later half of 1800s and early 1900s. The Corps' role in the development of commercial navigation dates back to 1823, when Congress assigned to it the overall task of developing navigation in the Great Lakes-St. Lawrence River, as well as the inland waterways. The Corps' Topographical Engineers were involved in surveying, charting, and construction on this system. By 1860, the small St. Marys Locks were expanded to facilitate direct navigation to Europe via the Erie and Merrit Canals which had been built between 1825-29. Merrit's Canal, with forty wooden locks, was the first facility to bypass the precipitous falls at the Niagara. These facilities were expanded between 1840-90. The Corps constructed the old Poe Lock on the St. Marys River in 1894 (Figure 3). The present Welland Canal is the third major renovation constructed from 1913-32 by Canada.

COMMERCIAL VESSELS

The first commercial navigation on the Great Lakes is credited to Sieur de La-Salle's 10-ton sailing vessel, launched in 1678 at the present site of Kingston, Ontario. This was followed by LaSalle's 40-ton ship that was used for commerce on Lakes Erie and Michigan-Huron. Tl subsequent opening of territories that are now the midwestern states and the development of settlements along the Great Lakes and St. Lawrence River necessitated the use of commercial vessels for the transport of grain and furs. Lake boats were used to transport grain from the upper lakes to Buffalo, New York, and then transferred to canal boats on the Erie Canal for delivery to New York City. Iron and coal soon eclipsed grain movement. With the Welland Canal expansion (1844) and completion of the 14-foot draft navigation by the Canadian Government (1905), the stage was set for future commercial navigation growth. Lake freighters facilitated the movement of bulk cargoes and made the system competitive with railroads. Radical changes were occurring in vessel design, resulting in propeller driven ships. The new Welland Canal (1932) had eight locks (each one was 860 feet long, 80 feet wide, and 30 feet deep) and could accommodate lak

VESSEL CLASSIFICATION		
Class	Overall hull Length in feet	No. of U.S. Vessels
1	Under 400	0
2	400-499	0
3	500-549	1
4	550-599	1
5	600-649	23
6	650-699	7
7	700-730	6
8	731-849	11
9	850-949	1
10	950-1000	13

Table 1

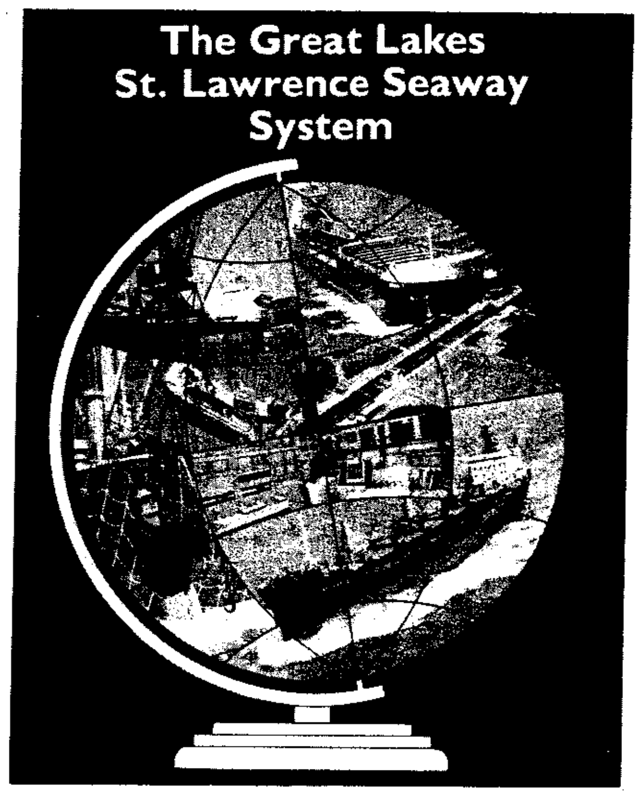

Figure 4 A montage of commercial navigation activities (Photo courtesy of Saint Lawrence Seaway Development Corp.)

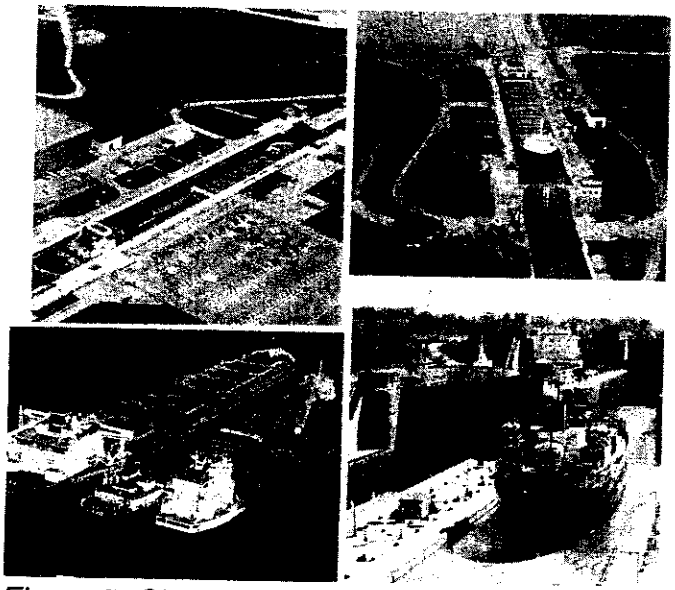

Figure 5 Clockwise from upper left are Eisenhower, Snell Locks, Welland Canal Lock and self-unloading ships are at work. (Photo courtesy of Saint Lawrence Seaway Development Corp.)

freighters of that time. It was not until after the opening of St. Lawrence Section of the Seaway in 1959 that ocean ships (730 feet long, 76 feet wide, and 26 feet draft; 29,000 tons) began to navigate the system (Figure 4). The Eisenhower and Snell Locks (Figure 5) on the St. Lawrence River are similar in size to the Welland Canal and St. Marys River Locks. One exception is the Poe Lock on the St. Marys that can pass through 1000-foot vessels.

The maximum vessel capacity increased from 12,000 tons in the 1920s to 28,000 tons in 1970. By the mid-1970s, 1000-foot long self-unloading carriers capable of carrying 58,000 tons of iron ore began to navigate the system. Table 1 shows the size and number of U.S. vessels using the system.

REGIONAL RESOURCES AND ECONOMIC DEVELOPMENT

The Great Lakes-St. Lawrence River navigation system serves an area commonly referred to as the midcontinent region, which constitutes the industrial and agricultural heartland of North America. It encompasses 19 states and 3 Canadian Provinces (Ontario, Manitoba, and Saskatchewan). Over 80 million people, some 30 percent of the combined populations of Canada and the U.S., live in this area. Water transportation is vital to the region's industrial economy and is the link between the agricultural production regions of the west and the consuming areas of the east as well as the overseas markets.

Iron ore, coal, limestone and grain account for 85 percent of the 220 million tons of waterborne freight carried each year on the waterway. The remaining 15 percent includes overseas general cargo, petroleum products, cement, and chemicals. United States shipments consist primarily of iron ore from western Lake Superior to southern Lake Michigan and to Lake Erie; coal from southern Lake Michigan and Lake Erie ports to power plants, municipalities, and industries at other United States and Canadian ports; limestone from northern Lake Huron and western Lake Erie bound for the steel industrial centers; and grain from western Lake Superior, southern Lake Michigan, and western Lake Erie to Buffalo, New York, and Canadian ports on the St. Lawrence River. A large portion of Canada's commercial transits use ports on the lower St. Lawrence River. Grain constitutes the principal cargo downstream and iron ore the principal cargo upstream. About one-third of Canada's wheat and 5 percent of the United States grain exports pass through Great Lakes ports.

ARMY CORPS OF ENGINEERS' ROLE

The Corps maintains and operates four locks which it designed and constructed at Sault Ste. Marie, Michigan. Also, the Corps designed and constructed the Eisenhower and Snell Locks on the Saint Lawrence, but they are operated and maintained by the St. Lawrence Seaway Development Corporation, U.S. Department of Transportation. All work related to navigation at U.S. Great Lakes ports and the connecting channels of the system is supervised by the Corps to assure maintenance of minimum navigable depths. The controlling depth of the system is currently 27 feet.

The Corps is also the lead U.S. Federal engineering agency in the water management of Lake Superior, Niagara River, and Lake Ontario/St. Lawrence River. The management of these valuable water resources is overseen by the International Joint Commission (IJC) through the following three International boards: Lake Superior, Niagara, and St. Lawrence River. These boards are responsible for coordinating the operations of U.S. and Canadian hydropower and navigation entities to assure the implementation of the IJC's Orders of Approval. The North Central Division Commanding General is the U.S. Chairman of these IJC-appointed boards.

The Corps conducts systemic studies and measurements of flows and levels at several locations to supplement other Federal efforts in the basin. Additionally, Corps responsibilities include protecting the systemic interests of riparians, recreation, and the environment.

Table 2

1980-90 CARGO		
Year	**Soo Locks**	**Montreal-Lake Ontario**
1980	96.3	54.6
1981	96.2	55.8
1982	66.5	47.2
1983	78.6	49.7
1984	82.4	51.7
1985	74.2	41.1
1986	69.6	41.3
1987	85.8	44.1
1988	90.7	44.6
1989	85.0	40.9
1990	87.9	40.4*

Cargo load in million tons
** Provisional data*

JANUARY				
BASIN	1991*	AVERAGE	DIFF	% OF AVERAGE
Superior	2.1	1.9	+0.2	110%
Michigan-Huron	1.5	2.1	-0.6	71%
Erie	1.8	2.4	-0.6	75%
Ontario	1.7	2.7	-1.0	63%
Great Lakes	1.7	2.1	-0.4	81%

*Table 3 Precipitation Data (inches) * Provisional data*

COMMERCIAL ACTIVITY (1980-90)

Table 2 shows the current trend in commercial navigation in the system. It should be noted that vessel traffic which does not use the locks is not included in this table. The Seaway System is not used to its full capacity, despite the great cost savings compared to other modes of cargo transportation. With the exception of 2 years, the total tonnage that passed through the Soo Locks was above 70 million tons, and the average for this period was about 82 million tons. The maximum and minimum yearly cargo during this period for the Soo Locks were 96 and 67 million tons. The Welland Canal and the Eisenhower/Snell Locks had maximum and minimum ranges of 60 and 40 million tons and 51 and 37 million tons, respectively. The total number of vessel transits through the U.S. locks of the St. Lawrence River in the past decade fluctuated between 2,800 and 5,000. A maximum of 7,452 transits occurred in 1959. The Saint Lawrence Seaway Development Corporation, The St. Lawrence Seaway Authority of Canada, Port of Montreal, and Lake Carriers' Association have excellent publications on the subject providing the current statistics, marketing advice, and other assistance to potential domestic and foreign shippers. For further information on this subject you may want to read the following publications: Annual Report of Lake Carriers' Association; and public brochures published by the Saint Lawrence Seaway Development Corporation; and, Canadian government agencies.

PRECIPITATION

Across the Great Lakes basin, the winter of 1990-91 began with mild weather in December 1990. This continued into January 1991, with fewer than usual cold days. Precipitation was below average for January. The snowpack so far this winter is also below average. Overall basin-wide precipitation for January 1991 was about 1.7 inches with only Lake Superior experiencing above-average precipitation. The precipitation by lake basin for January is shown in the Table 3.

LAKE LEVELS

Lake Superior continued about 6 inches below average in January while Lakes St. Clair, Erie, and Ontario were 18, 20, and 15 inches, respectively, above their corresponding January averages. Lakes Michigan-Huron were near average level in January. The January seasonal trend was seen in all the lakes, although Lake Ontario experienced a steeper rise than usual for January.

LAKE REGULATION

Lake Superior outflow for January was in accordance with the Plan 1977-A. The minimum outflow of 55,000 cubic feet per second (cfs) occurred in January. The Lake Ontario outflows prescribed by Plan 1958-D during the first half of January were in excess of Plan 1958-D flows in order to eliminate previously accumulated underdischarges. Over-discharges were made during the latter part of January, after forming a stable ice cover on the lower and upper reaches of the river.

IJC LEVELS REFERENCE STUDY BOARD

The board held a joint meeting with its Working Committees Cochairs on January 15, in Lincolnshire, Illinois. Draft Work Plans have been prepared by each working committee and reviewed by the Citizens Advisory Committee (CAC) and the board. In response to initial review comments, the working committees have been asked to make changes to their plans. The Study Director will be consolidating the revised work plans into one document and present it to the board on February 25-26 at the joint board-CAC meeting in Windsor, Ontario. This document will include an overall study budget and schedule. Progress on the study will be reported in our future Update Letters.

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