RECONNAISSANCE REPORT

June 2002 (Revised February 2003)

GREAT LAKES NAVIGATION SYSTEM REVIEW

Great Lakes - St. Lawrence River System

US Army Corps
of Engineers®
Great Lakes &
Ohio River Division

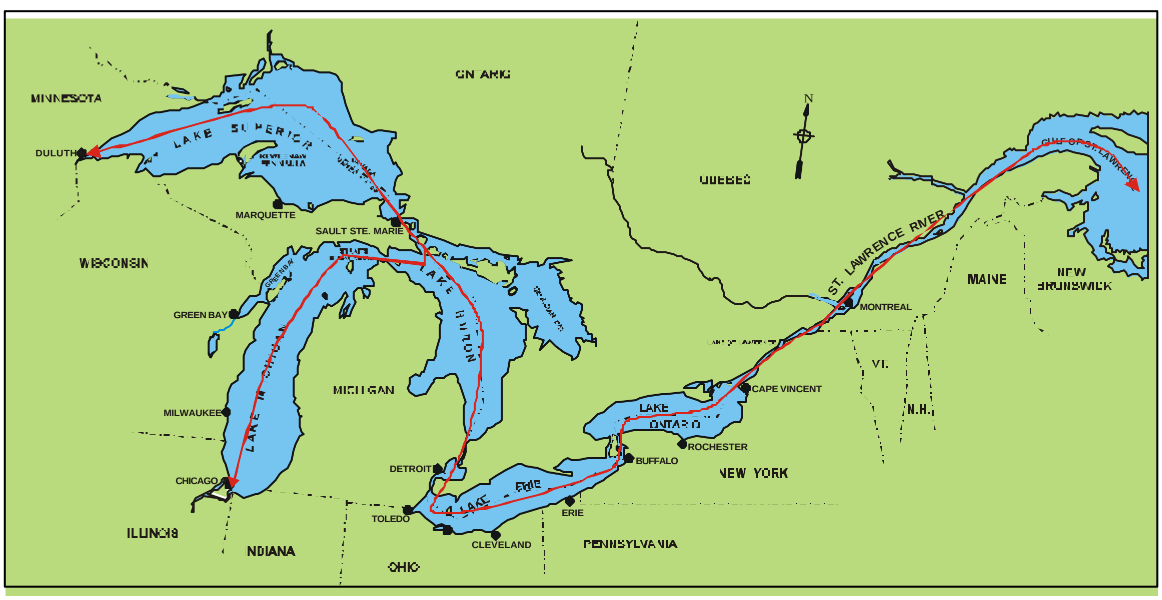
Report Summary

INTRODUCTION:

The Great Lakes/St. Lawrence River waterway corridor is unique for the scale and sophistication of its market and the extensive integration of its economy. This waterway runs alongside eight Great Lakes states and the provinces of Ontario and Quebec, home to almost 100 million people -- a third of the combined U.S.- Canadian population. The Great Lakes states, Ontario, and Quebec are by far the most manufacturing intensive regions of their respective countries. On the Canadian side, Ontario and Quebec represent over 60 percent of Canada's gross domestic product, while the Great Lakes states account for some 26 percent of the entire U.S. manufacturing base.

The waterway system extends more than 2,300 miles (3,700 kms) from the Gulf of St. Lawrence to the head of the Great Lakes at the Lake Superior ports of Duluth/Superior, Minnesota/Wisconsin and Thunder Bay, Ontario (see vicinity map on Figure 1). This direct water route to the heart of the North American continent puts Cleveland closer than Baltimore, in nautical miles, to European ports such as Liverpool and Hamburg. Over its course, from east to west, the waterway leads from the deepwater of the Gulf of St. Lawrence to Montreal, where the river is canalized in order to provide a 26'-3" draft[1], then through Lake Ontario and the Welland Canal, and finally into Lake Erie and the upper lakes. The portion of the Great Lakes/St. Lawrence River waterway between Montreal and the head of the lakes is referred to as the Great Lakes/St. Lawrence Seaway (GL/SLS).

FIGURE 1
Great Lakes/St. Lawrence Waterway Navigation System



[1] The available draft on the Seaway has been deepened over time to 26'-3". It is important to note that the available draft is always subject to the fluctuations of water levels on the system.

The GL/SLS system combines a remarkable natural resource with one of the world's great engineering feats to form a transportation network linking the middle of North America to the global marketplace. From a geographic perspective alone, the Great Lakes/St Lawrence Seaway system is unique in the world. The Great Lakes cover 95,170 square miles of water surface, about 61,000 in the U.S. and 34,000 in Canada, and defines a 10,000-mile coastline, which is longer than the entire U.S. Atlantic seaboard. The GL/SLS system was completed in 1959 with the opening of seven locks in the St. Lawrence River, complementing the 8 locks of the Welland Canal, thereby fulfilling a dream dating back to the 1700s to link the Great Lakes and Atlantic Ocean by a deep-draft channel. The development of the St. Lawrence Seaway coincided with and contributed to the emergence of the North American heartland as the world's preeminent center of agricultural and industrial production. See Attachment 1, Definition of terms, on page 46 for clarification of waterway segments.

The GL/SLS system has an enormous impact on the North American economy. It generates $3 billion annually and up to 17,000 jobs in Canada, and adds another $2 billion and some 50,000 jobs to the U.S. economy. For individual ports in the system, GL/SLS trade has been a catalyst for billions of dollars in capital investment and industrial growth. The base economies of many GL/SLS ports, and the entire Midwest, were defined by cost effective access to raw materials provided by the waterway. The GL/SLS has provided U.S. and Canadian farmers of the Great Plains an economical route to the world market for roughly 14 million metric tons a year of wheat, corn, soybeans and other products[2].

Maritime commerce on the GL/SLS involves two general trade communities: traffic moved on the Seaway, much of which is overseas import/export trade, and interlake domestic trades contained within the Great Lakes. The two universes are largely distinct, though they do both service the steel industry. Lakers hauling iron ore and "salties" specializing in steel both service the Great Lakes' steel industry.

The GL/SLS system is a true multi-modal system. Seamless movements of goods and commodities flow from ship to rail and truck and from rail and truck to ship in well-synchronized trade patterns. Some of the most successful GL/SLS trades rely on multimodal connections, such as low-sulfur coal railed to Great Lakes loading ports from Wyoming and Montana for shipment by self-unloading vessels throughout the Lakes and grain railed from the Canadian Prairie Provinces to Thunder Bay for direct export by ocean freighters.

It is no coincidence that the major rail and highway hubs of the mid-continent - such as Chicago, Toronto, Detroit and Toledo - are major GL/SLS ports as well. More than 40 provincial and interstate highways and nearly 30 rail lines link the 65 major and regional ports of the system with consumers and industries all over North America

The vessels, waterways, and ports of the GL/SLS system provide consistently safe and reliable service, while still keeping transportation costs competitive for the industrial and agricultural heart of North America. Studies also indicate that marine transport uses less fuel and has lower emissions

---

[2] "2001/02 Great Lakes/St. Lawrence Seaway System Directory". Published in cooperation with the St. Lawrence Seaway Management Corporation and the St Lawrence Seaway Development Corporation.

than either rail or truck for equivalent cargoes and distances. The large cargo capacity relative to engine size and the operating characteristics of Great Lakes and Seaway vessels make them models of fuel efficiency. A laker, for instance, uses about one gallon of fuel per one ton of iron ore per round trip. A 1993 study by the Great Lakes Commission found that vessel transportation on the GL/SLS system uses considerably less fuel, produces fewer emissions, and is less prone to pollution causing spills than if the same cargoes were transported by either truck or rail.

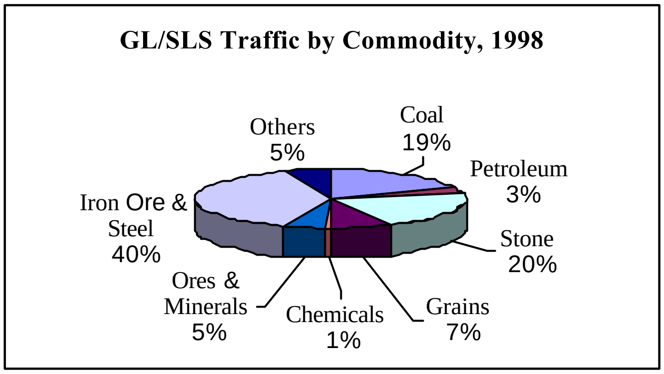
VESSEL AND TRAFFIC PROFILES AND PROJECTIONS

a. The Vessel Fleet. Vessel fleets are a critical consideration in planning future investments on any waterway. The Great Lakes/St. Lawrence Seaway (GL/SLS) is unique in the world in that it has three distinct fleets operating in its waters: 1) an intra-laker fleet, 2) a laker/Seaway fleet, and 3) a laker/Seaway oceangoing fleet of “salties”. Each fleet is compatible with the traffic and market the fleet is designed to serve. The intra-laker fleet, a U.S. fleet, is dominated by the Class X thousand footers and the smaller Class VIIIs that shuttle between ore and coal docks on Lake Superior and power plants and steel mills on the upper lakes. The laker/seaway fleet, primarily a Canadian fleet, is dominated by the Seaway compatible Class VII vessel making complementary moves of grain from Lake Superior to grain elevators on the lower St. Lawrence and iron ore from the lower St. Lawrence to steel mills on Lake Ontario and the upper lakes. The oceangoing fleet of “salties” is dominated by tramp operators bringing commodities such as steel slab from overseas origins into the lakes, taking-on light loads of grain in Lake Superior before moving back to the lower St. Lawrence where they are topped-off with grain before continuing on to overseas destinations. The practice of light loading is required due to limitations on available draft on the Great Lakes Connecting Channels and St Lawrence Seaway.

While 70% of the world’s fleet can transit the 80’ x 766’ locks and the 26’-3” channel of the Seaway, these vessels represent only 13 percent of world vessel capacity and 5 percent of the world container vessel capacity (See Appendix A- Economic Analysis, Section 5, Table 5-2 for details). The standardization of vessel loads in pallets, big bags, barge carriers, roll-on/roll-off and, most importantly, containers, and the coincidental investment in port infrastructure to handle these standard loads has allowed vessel owners to build bigger ships without increasing time-in-port for loading and unloading. These technical advances support the rapid growth of intercontinental trade. Ever larger ships are being built, indicating that the percentage of the world fleet that is Seaway capable will continue to decline in the foreseeable future. However, a deeper, wider Seaway could accommodate 34 percent (in terms of capacity) of the world fleet and, most importantly, 27 percent of the world container fleet in terms of gross ton capacity.

b. Overview of Commerce on the GL/SLS. As shown in Figure 2, the movement of iron ore and steel, coal and stone dominates GL/SLS traffic. All four commodities support the steel industry in part or in whole, though shipments of coal are primarily to electric utilities. The agriculture industry is also an important waterway user, shipping grains from Lake Superior ports through the St. Lawrence Seaway to ports along the lower St. Lawrence River (mostly for eventual shipment overseas) or directly to overseas destinations.

FIGURE 2



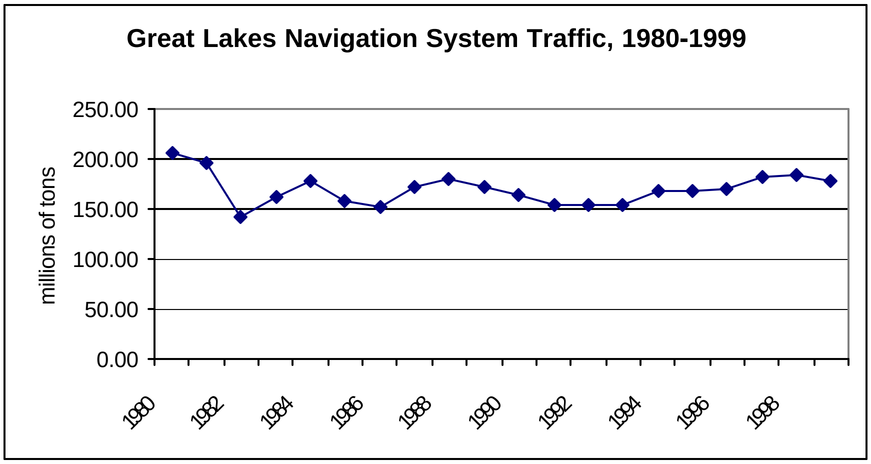
Traffic data for the GL/SLS was constructed from separate Canadian and U.S. sources as no comprehensive data base exists. In 1998, the single year for which a data base was built, 222.0 million tons of traffic moved on the GL/SLS. The U.S. component of the GL/SLS trade is dominated by waterborne trade between U.S. ports (127.6 million tons), making it the largest origin-destination flow. The next three largest flows are traffic from the U.S. to Canada (32.4 million tons), from Canada to Canada (26.1 million tons), and from Canada to the U.S. (20.5 million tons). The overseas trade is relatively small, 9.4 million tons enter the GL/SLS as imports, and 6.0 million tons leave the GL/SLS as exports from Canada and the U.S. to overseas destinations.

The movement of iron ore from U.S. ports on Lake Superior to steel mills along Lake Michigan, the Detroit River, Lake Erie and Lake Ontario is the largest commodity flow (60.4 million tons). The second and fourth largest flows are aggregates moving from U.S. ports on Lake Huron and Lake Erie, primarily to iron ore processing mills on Lake Superior, to steel mills, and to construction material yards in major metropolitan areas. Downbound flows of coal are the third largest commodity flow; Powder River Basin coals moving from Lake Superior to lakeside electric utility plant in both the U.S. and Canada dominate this flow. The fifth largest flow is Quebec/Labrador iron ores moving up the St. Lawrence River to steel mills primarily on lakes Ontario and Erie.

There are two distinct components to the GL/SLS: the Great Lakes Navigation System (GLNS) and the St. Lawrence Seaway. Each is discussed separately in subsequent paragraphs.

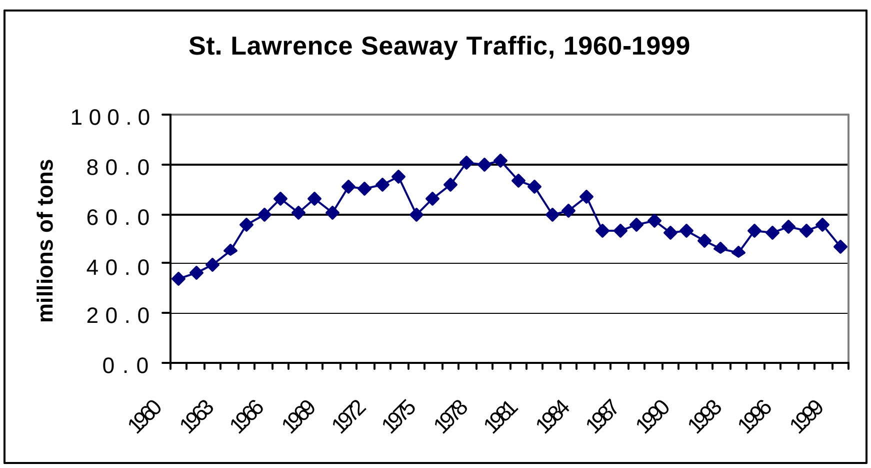
1.) Great Lakes Navigation System. The GLNS comprises the upper four Great Lakes and their navigable connecting channels – the St. Marys River, the Straits of Mackinac, and the St. Clair/Detroit River System. In the past 20 years, the most dramatic change in GLNS traffic occurred between 1980 and 1982. Traffic declined by 64 million tons in this two year period; the drop coinciding with a recession induced downsizing of the U.S. steel industry, primarily affecting integrated mills on Lake Erie and in the Ohio and Monongahela River valleys. Some recovery occurred over the next two years, but the GLNS has not reached the 200 million ton traffic level since 1980 (see Figure 3).

FIGURE 3



2.) St. Lawrence Seaway. The St. Lawrence Seaway is the second major component of the GL/SLS. The Seaway connects the upper four Great Lakes with the deepwater channel of the lower St. Lawrence River and from there on to the Atlantic Ocean. Traffic on the Seaway grew rapidly its first 7 years and continued to grow, with some interruptions, up until 1980 (see Figure 4). This 20-year period of growth was followed by fairly sharp decline with traffic falling from a high of 82 million tons in 1979 to 53 million tons in 1985. Grain exports through the Seaway weakened as the former Soviet Union withdrew from the world grain market, Western Europe became more agriculturally self-sufficient, and rail subsidies favored the movement of Canadian grains to developing west coast ports servicing the rapidly growing Asian market. Iron ore moving from Canadian mines in Quebec and Labrador to U.S. steel mills declined as that industry retrenched and focused on U.S. sources for ore. Seaway traffic stabilized in the 1990s.

FIGURE 4



c. Projected Traffic Demands. There are two components to the total traffic demand projections developed for the reconnaissance study -- demands based upon the existing fleet, waterway system and traffic, and demands associated with a less constrained system. Total traffic demand projections associated with the existing system are presented in Table 1. These demands are shown to increase from a level of 232 million tons in 2000 to about 356 million tons by year

2060, reflecting annual growth of about 0.7 percent. The St. Lawrence Seaway subsystem grows slightly faster, at about 0.8 percent per annum, and annually accounts for about one quarter of the traffic on the larger system. The GLNS grows at a rate of about 0.7 percent. Nearly all Seaway traffic moves on the GLNS, explaining why GLNS traffic accounts for 99 percent of GL/SLS traffic.

TABLE 1
Traffic Demand Forecasts, Great Lakes and St. Lawrence Seaway, 1998-2060
(millions of tons)

Year	Great Lakes Navigation System	St. Lawrence Seaway	Great Lakes/ St. Lawrence Seaway [1]
1998	227	61	228
2000	232	62	232
2010	255	67	255
2020	275	73	276
2030	291	80	292
2040	314	87	315
2050	335	93	336
2060	356	99	357
Annual Growth			
1998-60	0.7%	0.8%	0.7%

NOTE: Data includes both U.S. and Canadian traffic.
(1) Due to overlapping traffic, the Great Lakes/St. Lawrence Seaway totals are not the sum of the Great Lakes Navigation System & St. Lawrence Seaway traffic.
See Appendix A-Economic Analysis, Section 4 for details.

The second component of system traffic demands is potential shift of mode traffic demand. This traffic, resulting from increased system dimensions, is additional to the existing traffic. Two transportation studies were used to indicate additional traffic demand. A transportation-cost analysis for an improved Seaway identified potential bulk Seaway traffic, and a container transportation-savings analysis indicated the potential for container traffic on the GL/SLS. The container analysis shows some potential for existing-overland East Coast-Great Lakes container traffic to divert to the Seaway. Additional bulk traffic demands are mostly for export grain. Table 2 displays the additional traffic demand forecasts.

TABLE 2
Additional Traffic Demand Forecasts,
35' Great Lakes/St. Lawrence Seaway

	2010	2020	2030	Annual % Change 2000 - 2030
Additional Traffic				
Containers (in TEUs) *	2,227,999	2,965,300	3,946,594	2.9%
Bulk (in millions of tons)	6.54	7.01	7.52	0.7%

* Twenty Ton Equivalent Units
See Appendix A- Economic Analysis, Section 4, page 23, Section 6, page 8 and Attachment 4 for details.

PLAN FORMULATION

The Army Corps of Engineers, as the Federal government's largest water resources development and management agency, began its water resources (civil works) program in 1824. At that time, Congress appropriated funds for improving navigation. Since then, the Corps has been involved in improving navigation in rivers and harbors, reducing flood damage, and restoring degrading ecosystems. The Federal interest in navigation improvements stems from the Commerce Clause of the Constitution. The primary objective of navigation improvements is to assist in the development, safety, and reliability of waterborne commerce. Navigation in the nation's ports and inland waterways is an essential component of our national transportation system.

This reconnaissance analysis was prepared as an initial response to Section 456 of the Water Resources Development Act (WRDA) of 1999, which authorized the Great Lakes Navigation System Review. The full text of the Act is as follows:

> *"In consultation with the St Lawrence Seaway Development Corporation, the secretary shall review the Great Lakes Connecting Channels and Harbors Report dated March 1985 to determine the feasibility of undertaking any modification of the recommendations made in the report to improve commercial navigation on the Great Lakes navigation system, including locks, dams, harbors, ports channels, and other related features."*

a. Planning Process. A civil works project evolves from an idea about how to solve a problem and to formulate a solution that reflects both national and local interests. A project typically involves five phases: (1) reconnaissance, (2) feasibility, (3) pre-construction engineering and design, (4) construction, and (5) operation and maintenance. The primary purpose of the reconnaissance phase (first phase) is to determine if there is federal interest in proceeding with the feasibility phase.

The Great Lakes Navigation System reconnaissance study was initiated on Jan 15, 2001. It is a multi-district study, which includes team members from Chicago, Buffalo, Huntington, Louisville, and Detroit districts, with Detroit as the lead district. Four study teams were organized for the study: plan formulation, engineering, environmental, and economics.

To identify problems, opportunities, and potential improvements to the navigation system, a survey was conducted which included international, federal, public and private stakeholders of the Great Lakes/St. Lawrence Seaway (GL/SLS) navigation system. Problems, opportunities and potential improvements to the St. Lawrence Seaway portion of the navigation system were identified through coordination with both the Saint Lawrence Seaway Development Corporation (U.S.) and the St. Lawrence Seaway Management Corporation (Canada). Primary concerns among stakeholders were the limitations on vessel drafts and restrictive channel and port depths, narrow channels (applicable specifically to the Chicago Sanitary and Ship Canal), restrictive lock sizes and channel depths on the St. Lawrence Seaway, and the future reliability of lock structures on the Welland Canal and Montreal-Lake Ontario (MLO) section of the Seaway. Alternatives were then formulated using input from surveys and discussions with stakeholders. For the purposes of determining a

Federal interest in further studies, alternatives were developed incorporating the following elements:

* Deepening the Great Lakes connecting channels - potential channel and port modifications to improve vessel traffic, primarily deepening the channels.

* Improvements to the St. Lawrence Seaway[3] - replacing the existing locks with larger and deeper chambers and providing channels compatible with the larger lock dimensions.

* Deepening individual ports - improvements to the ports and harbors within the Great Lakes system. These improvements would include modifications to existing infrastructure and channels to accommodate deeper draft vessel traffic.

The alternatives identified based on these surveys do not represent the full range of alternatives to be evaluated. A more extensive process of problems identification and formulation and evaluation of alternatives would be completed during the feasibility phase of the study.

b. Without-project Conditions. The future without-project condition for the Great Lakes Navigation System (GLNS) assumes completion of authorized improvements at the Soo Locks, while maintaining the status quo elsewhere on the U.S. portion of the GLNS. The Soo Locks consist of four parallel locks, located on the St. Marys River, at Sault Ste. Marie, Michigan and the improvements include replacing the Davis and Sabin locks with one combined lock. On the U.S. portion of the GLNS a minimum draft of 25’6” LWD at all locks and connecting channels is maintained over the next 70 years. On the Seaway, a 26’3” draft is maintained. The aging Seaway locks are first maintained through normal operation and maintenance (O&M), then limited rehabilitation, and ultimately major rehabilitations. Each successively more aggressive approach to maintenance is phased in as the condition of Seaway locks deteriorates, requiring longer closures, which through time begin to occur during the navigation season, sometimes without advance notice to shippers. The single lock configuration in most locations makes the reliability of the overall system an even greater concern than it might be for dual-lock systems. The consequences of a major lock failure likely would cause traffic disruptions of the entire waterway.

The locks on the Welland Canal are at least seventy years old, while the locks on the Montreal/Lake Ontario (MLO) portion are forty-four years old. Maintaining the locks will likely result in repairs that address immediate concerns, however, these repairs may not be sufficient in scope to deal with the underlying structural problems. A comprehensive program with major expenses in lock rehabilitation will have to be initiated to keep the locks functional. Before a decision is made to make investments of this magnitude, an analysis should be completed to determine if it makes economic sense to rehabilitate the locks versus building new locks. Ultimately, the locks may face closure if a wide-ranging program to rebuild or repair the locks is not initiated.

With respect to the individual ports and harbors, the future without-project condition will be to maintain the existing project depths in the channels through ordinary operations and maintenance.

[3] "The St. Lawrence Seaway includes the waters of the St. Lawrence River above Montreal, Lake Ontario, the Welland Canal, and Lake Erie as far west as Long Point " from United States Coast Pilot 6 (31st Edition).

c. With-Project Conditions. Five broad options were developed for evaluation during the reconnaissance phase (see Table 3). Each option has three components. The first component being the U.S. portion of the GLNS, the second the Welland Canal Section of the Seaway, and the third is the MLO Section of the Seaway.

Option 1 - Includes the many combinations of improvement alternatives for the Great Lakes connecting channels and harbors combined with eventual replacement of the Seaway locks at current dimensions.

Option 2 - Contemplates the same improvements as Option 1 above, coupled with construction of a deeper (35' draft) and larger (110'x1200' lock chambers) Welland Canal.

Option 3 - Builds upon Option 2 by replacing the MLO Section of the Seaway with a deeper and larger system of locks and channels, and by extending the 35' draft system up to Detroit.

Option 4 - Is the same as Option 3, except that the 35' draft now extends into Lake Michigan and Lake Huron by the deepening of the entire St.Clair/Detroit River system.

Option 5 - Extends the 35' draft throughout the GL/SLS system as a result of deepening the St. Marys River and lowering the sill depth of the Soo locks.

TABLE 3
With-Project Conditions

Alternative	U.S. GLNS Connecting Channels & Ports	Welland Canal Section—Seaway	MLO Section--Seaway
Option 1	Deepen up to 30' draft	WOPC	WOPC
Option 2	Deepen up to 30' draft	Replacement of Locks 110'x1200', draft 35'	WOPC
Option 3	Deepen up to 30' draft, except Detroit R. at 35'	Replacement of Locks 110'x1200', draft 35'	Replacement of Locks 110'x1200', draft 35'
Option 4	Deepen up to 35' draft, except St. Marys R. at 30'	Replacement of Locks 110'x1200', draft 35'	Replacement of Locks 110'x1200', draft 35'
Option 5	Deepen up to 35' draft all connecting channels	Replacement of Locks 110'x1200', draft 35'	Replacement of Locks 110'x1200', draft 35'

Note: WOPC is the acronym for without-project condition.

ECONOMIC ANALYSIS

a. General. Four broad waterway improvement investment options (Options 1, 3, 4, and 5) were evaluated; Option 2 was omitted from reconnaissance-level consideration due to the difficulty in developing necessary benefit information. Owing to funding and time constraints, only a limited set of cost estimates were developed for the with-project alternatives, specifically: for Option 1 port and connecting channel plans, for some Chicago Sanitary and Ship Canal plans, and for the St. Clair/Detroit River system operational plans. As is appropriate for a reconnaissance level study effort, all estimates were developed utilizing existing information to the maximum extent possible.

The majority of the alternatives proposed for consideration for the Great Lakes Connecting Channels and Harbors portion of the navigation system have been evaluated under past studies and/or analyses. The quantities and estimates included in the past studies were used as the initial basis for development of cost estimates for this study. Where appropriate, and when lacking any definitive new data, previous estimates were updated utilizing the Corps of Engineers' Civil Works Construction Cost Index System.

No cost estimates were prepared for the without-project condition for the St. Lawrence Seaway or for Options 2, 3, 4, and 5, or for the 30' connecting channel plan under Option 1. Because lock reliability is a significant concern on the Seaway, a complete description and evaluation of the without-project condition alternatives is an especially important, analytically intensive effort. Nevertheless, completing the requisite engineering surveys, analyses, designs, and cost estimates for the 15-lock Seaway system is beyond the scope of this reconnaissance study.

Benefits for Option 1 connecting channels and port plans are based on U.S. domestic traffic and a portion of U.S. foreign traffic. It was not possible to model all traffic owing to systemic data deficiencies. These benefits, along with costs provided by the Engineering Team, are the basis of the benefit-cost analysis presented for Option 1 connecting channels and port plans. Benefits only are presented for the 30' connecting channel plan under Option 1 and the 35' draft alternatives described in Options 3, 4, and 5. As such, these benefits are intended as indicators of the possible presence or absence of federal interest. Finally, the benefits presented for the 30' and 35' draft alternatives assume federal and non-federal and waterside and landside infrastructure investments, and may require modification of the navigation season for the Seaway. Additional studies will be required to identify the extent to which the season may have to be lengthened to achieve viable commercial commerce.

b. Results. Specific connecting channels and port plans, Chicago Sanitary and Ship Canal plans, and St. Clair/Detroit River operational plans showed positive net benefits. In addition to these plans are the more comprehensive, system-wide alternatives. The benefits accruing to these plans are summarized in Table 4. Again, no costs were developed for these general, comprehensive alternatives.

TABLE 4
Summary of Average Annual Incremental Benefits
($ millions)

Category	Option 1	Option 2	Option 3	Option 4	Option 5
Incremental Annual Benefits					
Cost Reduction	$87	n.a.	$87	$87	$163
Shift of Mode					
Container	$0	n.a.	$293	$343	$343
Bulk Flows	$0	n.a.	$17	$17	$34
Economic Development	$0	n.a.	$400	$800	$800
Other Transportation Impacts	$0	n.a.	$88	$170	$170
Total Benefits	**$87**	n.a.	**$885**	**$1,417**	**$1,510**
Incremental Annual Costs	n.a.	n.a.	n.a.	n.a.	n.a.
Net Annual Benefits	n.a.	n.a.	n.a.	n.a.	n.a.
Benefit-Cost Ratio	n.a.	n.a.	n.a.	n.a.	n.a.

Note: n.a. indicates the value was not available. See Appendix A - Economic Appendix, Section 8 for details.

ENVIRONMENTAL CONSIDERATIONS:

The Great Lakes system is an ecological resource that continues to change as a result of human and natural forces. Global climate change has the potential to significantly influence water levels on the Great Lakes. Human inhabitation and development have resulted in changes in nutrient and contaminant loading, and the alteration of near-shore habitats. The consumptive use of resources due to over-fishing, water exportation, and mineral or energy extraction continue to be controversial issues. Introduced species, ranging from the sea lamprey and Pacific salmon to the zebra mussel and purple loosestrife, have resulted in dramatic changes in species composition and abundance, and the flow of energy through the ecosystem. As our understanding of the system grows, we anticipate that additional anthropogenic impacts can be minimized or mitigated.

The development of the Great Lakes navigation system has contributed significantly to the impacts cited above. Modification of the connecting channels has altered lake levels. Navigation system construction and related development have directly changed habitats. Industries locating in the Great Lakes due to shipping, and the resulting increase in population, have caused pollution. Opening up the system to traffic from the Atlantic Ocean has allowed the entry of a variety of invasive species. The most dramatic impacts to the ecosystem have likely already occurred, but further development of the navigation system does carry with it potential adverse effects. The environmental sustainability of the ecosystem must be considered when making decisions regarding improvements to the navigation system.

The action alternatives considered in this study share some of the same types of potential impacts. Construction activities would include building canals, locks, and water control structures, and dredging channels. Each of these activities has the potential to damage local habitat features, particularly near shore. Operation of a system that encourages use by more and larger vessels has the potential to increase aquatic habitat disruptions (through bow waves, drawdown and surge, and propeller wash) in terms of both frequency and severity. Maintenance of an enlarged system could also result in additional habitat disruptions or changes if additional maintenance dredging or disposal is required. Modification of the St. Lawrence Seaway would draw new overseas traffic that could increase the risks of introducing new exotic species. Changes in the navigation season could also potentially result in damage to restricted areas of the system.

On the positive side, improvements to the navigation system would reduce fuel consumption and atmospheric emissions related to the transportation of goods. Careful design and construction would also provide opportunities to incorporate environmentally beneficial features such as wetlands and spawning reefs which may help to restore ecological functions lost over the years. Reconstruction of locks in the St. Lawrence River may provide an opportunity for incorporating features to assist in the blockage of new aquatic nuisance species. Determining the overall significance of the proposed modifications will be a major effort requiring detailed site specific analyses of the alternatives carried into the feasibility stage, and the assessment of potential cumulative effects.

FEASIBILITY STUDY COSTS:

The total feasibility study cost is estimated to be approximately $20,000,000.

CONCLUSIONS AND RECOMMENDATIONS: Based on the reconnaissance analysis contained in this report it is concluded that there is Federal interest in proceeding with further studies of the Great Lakes and St. Lawrence Seaway Systems Study.

However, prior to initiation of the feasibility study, further information is needed. It is recommended that a supplement to the reconnaissance report, for clarification of the without project conditions and determination of the Federal interest, be undertaken. The purpose of this supplement is to provide needed information to support a Federal decision on whether to proceed with the feasibility study. This effort will include an assessment of baseline without-project conditions for the environment, engineering features and economic conditions, as well as public involvement and coordination. Should the recommendation be to proceed with further studies, this phase must also determine the scope of additional studies, including cost and duration, and develop a Project Management Plan. Since the system is a unique bi-national waterway, coordination with Canada that occurred during the development of the Reconnaissance Report, will continue during the reconnaissance phase as well as any future studies. Options for partnering with Canada in future study efforts are being investigated.

The following recommendations may be pursued independently:

(a) The GLSLS System Review identifies several ports on the Great Lakes where there is a federal interest in further studies. It is recommended that feasibility studies for these ports be conducted individually provided there is a non-Federal sponsor.

(b) It is recommended that a feasibility study be conducted individually for the Chicago Sanitary & Ship Canal provided there is non-Federal sponsor.

(c) It is recommended that a feasibility study be conducted individually for the St Clair River Ice Boom provided there is non-Federal sponsor.

(d) It is recommended that a feasibility study be conducted individually for Improved Water Level Data Access provided there is non-Federal sponsor.

(e) It is recommended that a feasibility study be conducted individually for Buoys and Beacons provided there is non-Federal sponsor.

Revised 2/3/03

RECONNAISSANCE REPORT
GREAT LAKES NAVIGATION SYSTEM REVIEW STUDY

JUNE 2002

US Army Corps
of Engineers®
Great Lakes &
Ohio River Division

RECONNAISSANCE REPORT
GREAT LAKES NAVIGATION SYSTEM REVIEW STUDY

TABLE OF CONTENTS

ITEM PAGE

TABLE OF CONTENTS (CONT.)

RECONNAISSANCE REPORT
GREAT LAKES NAVIGATION SYSTEM REVIEW STUDY

TABLE OF CONTENTS (CONT.)

LIST OF TABLES

LIST OF FIGURES

APPENDICES

GREAT LAKES NAVIGATION SYSTEM REVIEW
RECONNAISSANCE STUDY

1. STUDY AUTHORITY

a. This reconnaissance analysis was prepared as an initial response to Section 456 of the Water Resources Development Act (WRDA) of 1999, which authorized the Great Lakes Navigation System Review. The full text of the Act is as follows:

"In consultation with the St Lawrence Seaway Development Corporation, the secretary shall review the Great Lakes Connecting Channels and Harbors Report dated March 1985 to determine the feasibility of undertaking any modification of the recommendations made in the report to improve commercial navigation on the Great Lakes navigation system, including locks, dams, harbors, ports channels, and other related features."

The *Great Lakes Connecting Channels and Harbors* study was authorized by two separate resolutions of the Senate Committee on Public Works in 1969 and 1976, the study was originally to determine the advisability of further improvements in the Great Lakes Connecting Channels and Harbors in the interest of present and prospective deep- draft commerce with particular consideration of improvements for the safe operation of vessels up to the maximum size permitted by the St. Mary's Falls Canal. The study was expanded by the 1976 resolution to also determine the advisability of providing additional lockage facilities and increased capacity at the St. Mary's Falls Canal at Sault Ste. Marie, Michigan.

The two separate resolutions of the Senate Committee on Public Works for the *Great Lakes Connecting Channels and Harbors* study read as follows:

"*Resolved by the Committee on Public Works of the United States Senate, that the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby requested to review the report of the Chief of Engineers on the Great Lakes Connecting Channels, published as Senate Document Numbered 71, Eighty-Fourth Congress, and other pertinent reports, with a view to determining the advisability of further improvements in the Great Lakes Connecting Channels and Harbors in the interest of present and prospective deep-draft commerce, with particular consideration of improvements for the safe operation of vessels up to the maximum size permitted by the St. Mary's Falls Canal".* (Sponsored by Senator Stephen M. Young of Ohio, adopted 2 June 1969.)

"Resolved by the Committee on Public Works of the United States Senate, that the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby requested to review the reports of the Chief of Engineers on the Great Lakes Connecting Channels, published as Senate Document Numbered 71, Eighty—fourth Congress, and other previous reports, with a view to determine the advisability of providing additional lockage facilities and increased capacity at St. Mary's Falls Canal, Michigan".
(Sponsored by Senator Hugh Scott of Pennsylvania, adopted 30 April 1976.)

b. Funds in the amount of $500,000 were appropriated each in Fiscal Year 2001 and Fiscal Year 2002 to conduct the reconnaissance phase of the study.

2. STUDY PURPOSE

The purpose of the reconnaissance study is to determine if there is a Federal interest in providing commercial navigation improvements to the Great Lakes-St. Lawrence Seaway System (GL/SLS). The system provides a shipping link between the deep water of the Atlantic Ocean and U.S. and Canadian ports located as much as 2,400 miles inland on the North American continent. Major sections of the system include five Great Lakes, 1,000 statute miles of the St Lawrence River and 400 miles of connecting channels. In that distance there are sixteen sets of locks that lift ships from sea level to an elevation of 600 feet in Lake Superior.

In response to the study authority, the reconnaissance phase was initiated on 15 January 2001. This phase of the study resulted in the finding that there is Federal interest in continuing the study into the feasibility phase and that the proposed improvements are found to be consistent with army policies. The purpose of the reconnaissance analysis is to document the basis for this finding and establish the scope of the feasibility phase.

3. LOCATION OF PROJECT, NON-FEDERAL SPONSOR AND CONGRESSIONAL DISTRICTS

a. The study area is located within the Great Lakes Basin, which includes the Great Lakes-St Lawrence Seaway System. The Great Lakes portion of the system encompasses the upper four Great Lakes and the connecting channels between Lake Superior and Lakes Michigan and Huron, and Lake Erie. The St. Lawrence Seaway portion of the system encompasses the Welland Canal, Lake Ontario and the St Lawrence River, which serves as the border between the U.S. and Canada. The Great Lakes-St Lawrence Seaway System borders the following U.S. states; Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, Wisconsin, and the following Canadian provinces; Quebec and Ontario (see Figure 1 in the Report Summary). See *Attachment 1, Definition of terms*, on page 46 for clarification of waterway segments.

b. This regional study includes eight Great Lakes states, and two Canadian provinces. No singular (state or regional) representative, or combination thereof, has been identified as a potential non-Federal sponsor to support a feasibility study of the Great Lakes/St. Lawrence Seaway System. However, the Canadian Government has indicated an interest in considering partnering in a joint U.S. – Canadian study of the Great Lakes/ St. Lawrence Seaway System, but has not officially come forward. The Canadian Government is aware of the requirements of a non-Federal sponsor. There is currently no provision in law for the Corps to partner with a foreign government in a feasibility study effort.

c. With regard to individual ports and harbors, there is interest in conducting individual feasibility studies, but potential non-Federal sponsors are waiting for a determination on whether the system wide study is to be carried forward.

d. The study area lies within the jurisdiction of the following Congressional Districts:

Illinois Congressional Districts:

Senator Richard J. Durbin, D
Senator Peter G. Fitzgerald, R

1st Bobby L. Rush (D)	7th Danny K. Davis (D)
2nd Jesse Jackson (D)	8th Philip M. Crane (R)
3rd William O. Lipinski (D)	9th Janice D. Schakowsky (D)
4th Luis Gutierrez (D)	10th Mark Steven Kirk (R)
5th Rod Blagojevich (D)	16th Donald Manzullo (R)
6th Henry J. Hyde (R)	

Indiana Congressional Districts:

Senator Paul Evan Bayh, D
Senator Richard Lugar, R

1st Peter J. Visclosky (D)
3rd Tim Roemer (D)

Michigan Congressional Districts:

Senator Carl Levin, D
Senator Debbie Stabenow, D

1st Bart Stupak (D)	10th David Bonier (D)
2nd Peter Hoekstra (R)	14th John Conyers (D)
5th James Barcia (D)	15th Carolyn Cheeks-Kilpatrick (D)
6th Fred S. Upton (R)	16th John Dingell (D)

Minnesota Congressional Districts:

Senator Paul Wellstone, D
Senator Mark Dayton, D

8th James L. Oberstar (D)

New York Congressional Districts:

Senator Charles Schumer, D
Senator Hillary Rodham Clinton, D

24th John M. McHugh (R)	29th John L. LaFalce (D)
25th James T. Walsh (R)	30th Jack Quinn (R)

27th Thomas Reynolds (R)
28th Louise M. Slaughter (D)
31st Armory (Amo) Houghton (R)

Ohio Congressional Districts:

Senator Mike Dewine, R
Senator George V. Voinovich, R

5th Paul E. Gillmor (R)
9th Marcy Kaptur (D)
10th Dennis J. Kucinich (D)
11th Stephanie Tubbs Jones (D)
13th Sherrod Brown (D)
19th Steven LaTourette (R)

Pennsylvania Congressional Districts:

Senator Arlen Specter, R
Senator Rick Santorum, R

21st Phil R. English (R)

Wisconsin Congressional Districts:

Senator Russel Feingold, D
Senator Herbert Kohl, D

1st Paul Ryan (R)
4th Gerald D. Kleczka (D)
5th Thomas M. Barrett (D)
6th Thomas E. Petri (R)
7th David R. Obey (D)
8th Mark Green (R)
9th James F. Sensenbrenner (R)

4. PRIOR STUDIES, REPORTS AND EXISTING WATER PROJECTS

An extensive amount of literature from prior studies and reports has been reviewed during the development of this report. Prior studies pertaining to economic and engineering data are listed within their respective appendix. Other studies are shown below include:

a. Prior Studies, Reports:

The following reports are being reviewed as part of this study:

(1). *Great Lakes Connecting Channels and Harbors, Stage 2 Documentation, Volume 1 and 2 March 1982.* Determine the advisability of further improvements in the Great Lakes Connecting Channels and Harbors in the interest of deep-draft commerce. Also determine the advisability of providing additional lockage facilities and increase capacity at the St. Marys Fall Canal at Sault Ste. Marie, Michigan

(2). *Great Lakes Connecting Channels and Harbors, Final Feasibility Report and Environmental Impact Statement, September 1985, (Revised January 1988).* Determine the advisability of further improvements in the Great Lakes Connecting Channels and Harbors in the interest of deep-draft commerce. The study also will determine the advisability of providing additional lockage facilities and increase capacity at the St. Marys Fall Canal at Sault Ste. Marie, Michigan.

(3). *St. Lawrence Seaway Additional Locks Study, Preliminary Feasibility Report, July 1982*. Determine the adequacy of the existing locks and channels in the U.S. Section of the St. Lawrence Seaway.

(4). *Fox River Channel, Green Bay Harbor, Wisconsin, Reconnaissance Report, Commercial Navigation Improvements, April 1991*. Determine the feasibility of modifying the existing commercial navigation harbor at Green Bay, WI to modernize the harbor for large vessels and international trade.

(5). *Menominee Harbor and River, Michigan and Wisconsin Reconnaissance Report*, Commercial Navigation Improvements, March 1991. Determine the feasibility of implementing improvements to the existing commercial navigation harbor at Menominee, WI and MI that was authorized in 1960.

(6). *An Overview of the Commercial Navigation Industry of the United States on the Great Lakes, June 1992, IWR Report 92-R-6*

(7). *Great Lakes Harbors Study.* The Final Report by the U.S. Army Corps of Engineers, dated November 1966, together with 38 interim reports, included recommendations that 30 harbors be improved and one harbor be built to provide a 27- draft depth commensurate with the 27—foot depths provided in the connecting channels, the Welland Canal, and the St. Lawrence River. These reports contain the economic and physical data and analyses used to justify improvements made during the late 1950's and early 1960's.

(8). *Great Lakes-St. Lawrence Seaway Navigation Season Extension Study*. Several reports were prepared and completed under this study by the U. S. Army Corps of Engineers as authorized by Section 107(a) and Section 107(b) of the 1970 River and Harbor Act. They include four Demonstration Program Annual Reports, 1972—1975; a Demonstration Program Report Summary, 1976.; and a Special Status Report, July 1974. Also included are: the *Final Demonstration Program Report*, completed September 1979, which documented the results of the Demonstration Program that was conducted under a cooperative effort among several Federal agencies and non-Federal public and private interests. *The Interim Feasibility Study, (House Document 96-181)* forwarded to the Congress on 3 August 1979 by the Secretary of the Army, recommended Federal participation in an extended navigation season on the upper four Great Lakes and their connecting channels to 31 January, plus or minus two weeks, using existing operational measures; *The Final Survey Report* recommended a 12—month navigation season on the upper three Great Lakes and their connecting channels, up to a 12—month navigation season on the St. Clair River—Lake St. Clair-Detroit River system and Lake Erie, and up to a 10—month navigation season on Lake Ontario and the International Section of the St. Lawrence River. The Final Survey Report was completed in August 1979 and forwarded to the Board of Engineers for Rivers and Harbors for Washington level review in January 1980. The Board completed its review in February 1981, and forwarded the report to the Chief of Engineers. The Chief of Engineers has forwarded his report to the Secretary of the Army for subsequent coordination. The Secretary of the Army stated that the season extension is primarily an operational matter with which the Corps has adequate authority.

b. Existing Water Projects:

This study is investigating potential modifications of the following project(s):

Deepening Ports:

1. Alpena, MI
2. Ashtabula Harbor, OH
3. Buffalo Harbor, NY
4. Burns Waterway Harbor, IN
5. Calcite Harbor, MI
6. Calumet Harbor/Lake Calumet, IL & IN
7 Chicago Harbor, IL
8 Cleveland Harbor, OH
9. Conneaut Harbor, OH
10 Detroit River, MI
11 Drummond Island, MI
12. Duluth-Superior Harbor, MN/WI.
13. Escanaba Harbor, MI
14. Fairport, OH
15. Gary Harbor, IN
16. Green Bay Harbor, WI
17. Indiana Harbor, IN
18. Lorain Harbor, OH
19. Marinette-Menominee Hbr, WI/MI.
20. Milwaukee, WI
21. Monroe Harbor, MI
22. Presque Isle, MI
23. Rouge River, MI
24. Saginaw River, MI
25. Sandusky Harbor, OH
26. Saugatuck, MI
27. Sheboygan, WI
28. Silver Bay Harbor, MN
29. St Clair River, MI
30. Stoneport, MI
31. Taconite Harbor, MN
32. Toledo Harbor, OH
33. Two Harbors Harbor, MN

Screening procedures were developed to identify harbors that have potential for deepening. The first screening was by tonnage; all ports that ship or receive over 1 million tons per year. See additional discussion on page 33, *Deepening Individual Ports.* Trade between these 33 harbors, if accomplished through additional navigation system modifications, could result in benefits, which could immediately be "applied" against the system-wide costs of those modifications. System wide modifications may include the following:

Deepening Great Lakes Connecting Channels:

1. St. Marys River
2. St. Clair River
3. Channels in Lake St. Clair
4. Detroit River

Increased Capacity to the St. Lawrence Seaway:

1. Additional Lock, parallel to the Snell Lock, located near Massena, NY
2. Additional Lock, parallel to the Eisenhower Lock, located near Massena, NY

Improve Navigation Restrictions:

1. Chicago Sanitary Ship Canal
2. St. Clair River Ice Boom
3. Improved Water Level Data Access
4. Aids To Navigation

5. PLAN FORMULATION

Plan formulation is the process of combining various management measures into comprehensive water and related land resources alternative plans of action that meet the goals defined in the study authorization. The study objective is to formulate alternative plans that respond to national, regional and local objectives and resolve identified problems, meet commercial navigation needs and facilitate opportunities.

a. General:

A number of Federal, State and local agencies, academic institutions, and citizens groups have expressed interest in the reconnaissance study and participated in the development of the reconnaissance analysis. Input was formally solicited on January 17, 2001, on the scope of the GLNS reconnaissance study. Comments were received from a wide variety of users, stakeholders, Government agencies and other private interests of the Great Lakes and St. Lawrence Seaway system. In addition, a web site http://www.lre.usace.army.mil/glnav/INDEX.HTM for the GLNS reconnaissance study was created to facilitate the sharing of information about the study.

Coordination and cooperation are essential to determine whether pertinent data is already in existence; to arrange schedules for obtaining assistance and obtaining additional data without duplication; to exchange information; to discuss proposed plans and to identify areas where there may be complementary effects. The following is a list of agencies with which this study is being coordinated:

FEDERAL AGENCIES

UNITED STATES

U.S. Department of Interior
U.S. Fish and Wildlife Service
U.S. Department of Transportation
St. Lawrence Seaway Development Corporation
U.S. Coast Guard
U.S. Department of Transportation, Maritime Administration
Federal Highway Administration
U.S. Department of Agriculture
Advisory Council on Historic Preservation
U.S. Department of Commerce
National Oceanic & Atmospheric Administration
Bureau of Indian Affairs

Environmental Protection Agency
Federal Energy Regulatory Commission
U.S. Forest Service
U.S. Department of Health, Education & Welfare
Public Health Service

CANADIAN

St. Lawrence Seaway Management Corporation
Fisheries and Oceans Canada
Coast Guard, Canada
Department of Environment, Canada
Ministry of Transport, Canada
Toronto Harbor Commissioners

SOVEREIGN NATIVE AMERICAN NATIONALS AND AFFILIATED AGENCIES

Great Lakes Intertribal Council
Great Lakes Agency, Bureau of Indian Affairs
Great Lakes Indian Fish & Wildlife Commission

STATE AGENCIES

Michigan Department of Natural Resources
Michigan Department of Environmental Quality
Wisconsin Department of Transportation
Coastal Zone Management Office
Department of Agriculture
Michigan State Historic Preservation Office
Minnesota State Historical Society
New York State Department of Environmental Conservation
Minnesota Pollution Control Agency
Pennsylvania Department of Conservation and Natural Resources

REGIONAL

International Joint Commission
Great Lakes Commission
Great Lakes Fishery Commission
Ohio Rail Development Commission

LOCAL AGENCIES

Great Lakes Port Authorities
Duluth Seaway Port Authority
Detroit/Wayne County Port authority

Port of Oswego Authority
Indiana Port Commission
Port of Cleveland
Toledo-Lucas County Port Authority
Ohio Rail Development Commission
Counties whose boundaries borders the Great Lakes States & St. Lawrence Seaway
Cities whose boundaries borders the Great Lakes States & St. Lawrence Seaway

<u>ORGANIZED GROUPS</u> (Includes such interests as: recreational, business, conservation, industrial, environmental, professional, educational, utility, labor, or community.)

St. Lawrence County Environmental Management Council
Great Lakes Research Consortium
United States Great Lakes Shipping Association
Lake Carriers Association
National Wildlife Federation
Great Lakes Natural Resource Center
Save The River
Thousand Island Heritage Conservancy
Ducks Unlimited
Detroit Audubon Conservation Committee
Clinton River Watershed Council
Edison Sault Electric Company
Illinois River Carriers' Association
Chamber of Maritime Commerce
Strategies Saint-Laurent Inc.
Shipping Federation of Canada

b. <u>National and Regional Objectives:</u>

(1). The national or Federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal Planning requirements. Contributions to national economic development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the nation.

(2). The Corps has added a second national objective for Ecosystem Restoration in response to legislation and administrative policy. This objective is to contribute to the nation's ecosystems through ecosystem restoration, with contributions measured by changes in the amounts and values of habitat.

c. Public Concerns:

The concerned public is interested in consideration of measures required to satisfy recreation opportunities, minimizing water quality degradation, and making special efforts to preserve the environment of the Great Lakes-St Lawrence Seaway area. Environmentalists are concerned with larger facilities and the potential effects these facilities could have on the surrounding environment. Shore erosion and flooding are major concerns of shoreline property owners. Terminal and transfer facilities are also a concern of the study since larger vessels would likely require some modifications of present operating procedures. Railroads and other alternate modes of transportation are also interested since they could be influenced by future action on the Great Lakes-St. Lawrence Seaway system. The most productive use of the Great Lakes-St. Lawrence Seaway system is a mutual concern of both Federal and State agencies. International concern is also involved because of the international traffic moving on the Great Lakes.

d. Description of Existing Conditions:

A general survey of the geography, resources, development, and economy of the region tributary to the Great Lakes-St. Lawrence Seaway System provides a benchmark against which potential impacts from proposed modifications to the existing commercial navigation system can be evaluated.

The region provides a good "quality of life" through its beautiful scenery, fishing, swimming, power boating and sailing, and through agriculture, mining, manufacturing, water and power supply, and transportation. All these activities are dependent upon the water resources of the system.

(1). Physical Setting

Climate

In general, the Great Lakes experiences a continental; semi-maritime climate, largely determined by the prevailing winds from west to east and the modifying influences of the Great Lakes. The region is normally humid throughout the year, with cold winters and cool summers in the north and warm summers in the south. The average annual frost-free season is about four months at the northern extremity of the basin and about six months at the southern extremity. Mean annual surface air temperatures over the basin range from about 4^{o}C (39°F) on Lake Superior to 9°C (49°F) on Lake Erie. Average temperature for each of the lakes is lowest in February and highest in July.

The Great Lakes store great quantities of heat and tend to moderate temperatures on the adjacent land areas. Thus, the interiors of Michigan's Upper and Lower Peninsulas are colder than areas nearer the lakes at the same latitude. The Great Lakes cause an increase of average annual humidity on the order of 15 percent. Short—term local variations in surface air temperatures can be extreme. Intense cells of cold arctic air can lower temperatures as much as 28^{o}C (50^{o} F) in one day.

Geology

“The Great Lakes have attained their present form and connections as a result of a complicated series of events. Many of the basic attributes of the lakes, such as their locations, depths, and shapes, were indirectly influenced by events which occurred as much as a half-billion years ago, when the bedrock foundation of the region was laid down. The bedrock terrain, with various degrees of resistance to erosion, was sculptured by weathering and stream erosion over a period of some 180 million years. During the last million years, continental ice sheets invaded the region several times and scoured and molded the landscape.

The earliest known predecessors of the modern Great Lakes are relatively recent arrivals on the scene. They came into existence probably not more than 20,000 years ago, when the wasting margin of the last continental ice sheet retreated into the lake basins. The earliest lakes were narrow, ice-margin bodies of water which expanded as ice melted and which were compressed in area at various times when ice sheets temporarily re-advanced. The lake waters at first spilled southward over the divides of the various lake basins. During the northward retreat of the border of the continental ice sheet, the lake waters found new, lower outlets in the north, and the lakes periodically drained down to lower levels – only to be returned to higher levels when uplift of the land raised northern outlets higher than the old southern outlets. The process of uplift continues today[1].”

Topography

The Superior Highlands of northern Minnesota, Wisconsin, and Michigan, range in elevation from about 600 to approximately 2,300 feet above mean sea level. Elevations in the interior lowlands range from 700 to 1,000 feet. In most of the basin, land surface is less than 1,000 feet above mean sea level. The highest point is the headwaters area of Lake Superior with an elevation of 2,301 feet above mean sea level at Eagle Mountain in Cook County, Minnesota, and the lowest elevation within the Great Lakes is about 570 feet above mean sea level at the lowlands adjoining Lake Erie.

The St Lawrence River is located in the St Lawrence Lowlands, which forms the northern section of the St Lawrence Valley Physiographic Province. The lowland is a broad area, less than 1,000 feet in altitude, bordered on the north by the Laurention Plateau and on the south by the uplands of the Adirondack Province.

Soils and Mineral Resources

The Great Lakes basin has large areas of relatively flat land with fine—textured soils of glacial origin. Included are the Iron River and Gogebic soils in Minnesota, Wisconsin, and the Upper Peninsula of Michigan. The Rubicon, AuGres, and Roscommon soils which occupy areas in Wisconsin and much of Michigan, are level to rolling, well drained to poorly drained sands. Southern Michigan, Indiana, western Ohio, and eastern Wisconsin include soils in rolling, calcareous glacial till and sand outwash materials. The Wooster-Mahoning soils occur in rolling, acid glacial till in eastern Ohio and Pennsylvania. The Ontario and Lordstown soils occupy much of western New York. The Ontario soils are deep, calcareous glacial till and the Lordstown soils are thin, acid glacial

[1] Geology of the Great Lakes, Jack L. Hough 1958

till over sandstone and shale.

Minerals are the foundation of the heavy industry that has developed in the Great Lakes Region. Virtually all of the metallic minerals, including iron, zinc, lead, silver, and copper, are found in the northwest and extreme eastern parts of the basin. Mineral fuels including oil and gas and non-metallics including limestone, dolomite, sandstone, shales, salt, gypsum, and natural brines, are found in lower Michigan, Ohio, Illinois, Indiana, and New York. Sand, gravel, clay, marl, and peat are generally found throughout the region. Only a small amount of coal is in the area, but in adjacent regions there are many large coal-mining operations, the output of which affects the economy of the region.

Shore Use, Erosion and Sedimentation

Shorelands are the focus of development in the Great Lakes region since they offer the opportunity for waterborne commerce, water supply, and recreation. Primary factors determining the type of shoreland use and development in a given area are geographical location, accessibility, ownership, topography and historical development.

Industrial, commercial, and permanent residential uses are concentrated in urban areas along lower Lakes Michigan, Huron, and Erie. Forested shorelands are almost exclusively confined to the northern areas of Michigan, Wisconsin, and Minnesota. Large tracts of forest and wildlife preserves are located along undeveloped lakeshore areas of Michigan, Wisconsin, and Minnesota. Located along the Great Lakes shores are the largest recreational developments in the Great Lakes basin, including three national lakeshores, 67 State parks, and numerous local community recreation areas. Shore erosion is a natural occurrence along the Great Lakes shoreline. Major causes of the shore erosion on the Great Lakes include underground water seepage, frost and ice action, surface water runoff, and wave action. Wind generated wave action causes the greatest erosion damage. Wave action works directly on the beach or at the toe of bluffs eroding away clay, silt, sand, and gravel. The intensity of damage caused by wave action varies with the magnitude of the waves generated, the elevation of the undisturbed lake level, the temporary increase in that level generated by wind or barometric pressure gradient, and the erodibility and exposure of the shorelands.

Water Quality and Supply

Federal, State, and local programs exist for the purpose of maintaining or enhancing water quality in the Great Lakes basin. The Federal programs are primarily the responsibility of the United States Environmental Protection Agency established by Reorganization Plan No. 3, effective 2 December 1970 (42 United States Code, annoted, Section 4321).

The adoption of water quality standards by all of the Great Lakes States facilitates the coordinated efforts to maintain and enhance water quality. From time to time it may be necessary to modify those standards to reflect changing conditions, changing information, and changing public opinion as to what constitutes best use of water related resources.

Fishery and Other Aquatic Resources

The fishery resources of the region constitute one of the major natural resources. The more than 237 species and subspecies of fish found in the waters of the Great Lakes represent most of the important families of fresh water fish in North America. Most of these species are indigenous to the basin, having entered the lakes during the last glaciating (the Wisconsin) period. In addition, exotic species are present, having been either purposely or inadvertently introduced by man. These introductions, along with past fishery management practices, have led to significant changes in the fishery resources of the basin.

Wildlife and Other Terrestrial Resources

There are approximately 220 species of birds and 18 species of mammals in the Great Lakes basin. Upland game birds found in the basin include ring necked pheasants, ruffed grouse, quail, and turkey. Waterfowl include several species of geese and many species of ducks. Typical shore and marsh birds include bitterns, rails, herons, loons, red-winged blackbirds, gulls, and terns. Common non-game birds include hawks, owls and many species of songbirds. Endangered bird species in the basin include the least tern, piping plover, and falcon Kirtland's warbler .

(2). The Great Lakes–St Lawrence Seaway Navigation System

The Great Lakes—St. Lawrence Seaway system extends from the western end of Lake Superior to the Gulf of St. Lawrence on the Atlantic Ocean, a distance of more than 2,000 miles. The five Great Lakes (Superior, Michigan, Huron, Erie and Ontario) with their connecting channels and Lake St. Clair, have a water surface area of about 95,000 square miles. The lakes lie partly in each of the two countries of Canada and the United States except for Lake Michigan, which lies wholly within the United States. The total area of the Great Lakes basin, both land and water, above the eastern end of Lake Ontario is approximately 292,000 square miles, of which 174,000 square miles are in the United States and 122,000 square miles are in Canada. The upper four Great Lakes and the connecting channels have a controlling commercial navigation safe draft of 25'-6". Characteristics of the five Great Lakes are as follows:

TABLE 1
GREAT LAKES CHARACTERISTICS

Great Lakes	Water Surface Area (sq. miles)	Length (miles)	Breadth (miles)	Maximum Depth (feet)	Drainage Area (sq. miles)
Lake Superior	31,700	350	160	1,333	81,000
Lake Huron	23,000	206	101	752	74,800
Lake Michigan	22,300	307	118	925	67,900
Lake Erie	9,900	241	57	212	33,500
Lake Ontario	7,600	193	53	804	34,800*

*Includes water surface area and tributary land area downstream to the St. Lawrence Power Project at Cornwall.

Hydraulics & Hydrology

Lake Superior has been regulated since 1921 by means of a series of control structures including a gated dam across the St. Marys River at Sault Ste. Marie, Michigan and Ontario. Construction of the gated dam was authorized by the International Joint Commission (IJC) as a condition to approval of the water diversion for hydropower. By operation of the gates, locks, and changes in power diversions, flows specified by the adopted plan of regulation can be achieved. The present plan of regulation is known as Plan 1977-A. Basically, the plan balances the levels of Lake Superior and Lakes Michigan-Huron to maintain their levels at the same position to each other according to their long-term monthly means, while protecting the maximum on Lake Superior. The plan of regulation is designed to meet criteria specified by the IJC which requires, among other things, that the control works be operated so that the mean level of Lake Superior would be retained within its normal range of stage such that the level shall not exceed elevation 603.2 feet IGLD (1985) or fall below elevation 599.6 feet IGLD (1985), and will be done in such a manner so as not to interfere with navigation. This regulation plan affects water levels on Lakes Superior, Michigan, Huron, and to a lesser degree, downstream through Lake Erie. A discussion of the Lake Superior regulatory works is presented in the Cost Engineering Appendix of this report.

<u>Lakes</u>

<u>Lake Superior</u> is the largest of the Upper Great Lakes. Compared with the other Great Lakes, its surface is more elevated above the Atlantic Ocean, is more irregular in outline, has deeper water more fog, and less rain. The main United States commercial harbors are located at Duluth and Two Harbors, Minnesota; Superior and Ashland, Wisconsin; and Marquette and Presque Isle, Michigan. Two additional United States harbors, constructed by private interests, are located in Minnesota on the north shore of Lake Superior at Silver Bay, and at Taconite Harbor at Two Islands. Each is used for the shipment of concentrated taconite—iron ore. In addition, there is an important Canadian harbor at Thunder Bay, Ontario.

<u>Lakes Huron and Michigan</u> are one lake from a navigation standpoint, since the Straits of Mackinac which connects the two lakes is so broad and deep there is no perceptible flow between them and their surfaces stand at the same elevation. Major harbors on Lake Huron located in the United States are at Calcite, Stoneport, Alpena, Alabaster, Bay City, and Saginaw. Major harbors on Lake Michigan are located at Port Inland, Escanaba, Muskegon, and Grand Haven, Michigan; Green Bay and Milwaukee, Wisconsin; Chicago and Calumet Harbor, Illinois; and at Burns Waterway, Buffington, Gary, and Indiana Harbor, Indiana.

<u>Lake Erie</u> is the shallowest of all the Great Lakes and considerably smaller than Lakes Superior, Michigan and Huron. Major harbors on Lake Erie are located at Monroe, Michigan; Toledo, Sandusky, Huron, Lorain, Cleveland, Fairport, Ashtabula, and Conneaut, Ohio; Erie, Pennsylvania; and Buffalo, New York.

<u>Lake Ontario</u> is the smallest of the Great Lakes. It is connected to Lake Erie by the Welland Canal which extends for about 27 miles and provides a series of locks that overcome a difference in elevation of 326 feet. Major U.S. harbors on Lake Ontario are located at Rochester, Sodus Bay, and Oswego, New York. Major Canadian harbors are located at Hamilton and Toronto, Ontario.

Connecting Channels

St. Marys River is the outlet of Lake Superior and leaves the lake at Point Iroquois, flowing in a generally southeasterly direction through several channels to Lake Huron, a distance of from 63 to 75 miles according to the route traversed. The river drops approximately 22 feet with most of the drop (20 feet) occurring at the St. Marys Falls Canal, where four U.S. navigation locks and one Canadian lock allow for the transit of vessels. The natural control of the outflow from Lake Superior was a rock ledge at the head of the St. Marys River. This natural control has been replaced by the locks, compensating works, and powerhouses. As a result, the outflow from Lake Superior is regulated. Of particular interest in the St. Marys River are the Sugar, Lime, Neebish, and Drummond Islands which are inhabited year round. Transportation to these islands is provided by ferryboat or tug during the summer. During the winter, transportation has traditionally been over the ice or by ferry boat through an established open water vessel track.

The St. Clair River—Lake St. Clair-Detroit River System connects Lake Huron and Lake Erie. The system on Lake Erie is approximately 89 miles long and has a relatively uniform water surface profile with a fall of 8 feet from Lake Huron to Lake Erie. The St. Clair River has a length of *about* 39 miles. Lake St. Clair, extending between the mouth of the St. Clair River and the head of the Detroit River (a distance of about 18 miles) occupies a shallow basin having an average depth of about 10 feet, with low, marshy shores. The shallow depth requires a dredged commercial navigation channel 27.5 feet deep and 800 feet wide throughout its length. The Detroit River extends about 32 miles to Lake Erie. Major harbors located along the system are at Sarnia and Windsor, Ontario, and at Detroit, Michigan. There are no commercial harbors on Lake St. Clair.

The Welland Canal connects Lake Erie and Lake Ontario. The system is approximately 27 miles long and is somewhat restricted by structures, but has no level and flow problems because it can be totally controlled by locking operations. The Welland Canal is crossed by 12 bridges, four railroads and eight highways. The lift bridges are considered bottlenecks to the vessel traffic. Two road tunnels and one railroad tunnel cross under the canal. Navigation is also restricted in some areas because of one-way traffic. Major harbors located in the vicinity of the Welland Canal include Toledo, Lorain, Cleveland, Ashtabula, and Conneaut, Ohio, Erie, Pennsylvania and Port of Buffalo, New York, and Hamilton, Ontario.

The St. Lawrence River connects Lake Ontario and the Atlantic Ocean. The system is approximately 189 miles long and is somewhat restricted by structures, and water level flow problems. There are 17 bridges across the St Lawrence River. The minimum clearance is 120 feet and minimum width is 80 feet. Tidal variations from Quebec seaward are quite large, up to 8 feet; however at Montreal and upstream the variation is only 6 inches.

The physical characteristics of the connecting channels are summarized below:

TABLE 2 GREAT LAKES-ST LAWRENCE SEAWAY CONNECTING CHANNELS CHARACTERISTICS				
Connecting Channel	Length (miles)	Width (feet)	Depth (Feet)	Fall (feet)
St. Marys River	63	300—1500	27-30	23
Straits of Mackinac	0.80	1250	30	0
St. Clair River	40	700—1400	27-30	5
Lake St. Clair	18	700— 800	27.5	0
Detroit River	31	300—1200	27.5—29.5	3
Welland Canal	27	192-350	26	326
St Lawrence River	189	225-600	26	226

The connecting channels are unregulated (free flow) except for the St. Marys River and St. Lawrence River, which is controlled by a series of improvements. Although compensating dikes were constructed on the Lower Detroit River to partially offset (hydraulically) the lowering of the water levels (due to past authorized navigational improvements in 1912, 1936, and 1962), the Detroit River is not considered regulated.

<u>Locks</u>

Locks in the Great Lakes-St. Lawrence Seaway system are located in the St. Marys River, Welland Canal and St. Lawrence River. In the St. Marys River at Sault Ste. Marie, Michigan and Ontario, four parallel locks on the U.S. side, and one on the Canadian side are operational. The principal features of the locks in the St. Marys River are shown in Table 3 as follows.

TABLE 3 PRINCIPAL FEATURES OF THE SAINT MARYS FALLS CANAL LOCKS					
Principal Features	Lock				
	MacArthur	Poe	Davis	Sabin	Canadian
Opened to Commerce	1943	1969	1914	1919	1895
Width, feet	80	110	80	80	59
Length between mitre sill, feet	800	1200	1350	1350	900
Depth on upper mitre sill, feet	31	32	24.3	24.3	16.8
Depth on lower mitre sill, feet	31	32	23.1	23.1	16.8
Lift, feet	22	22	22	22	22

<u>Welland Canal</u>. The Welland Canal is located in Canada about 20 miles west of the Niagara

River, and connects Lake Erie to Lake Ontario. It is 27 miles long and contains eight locks. The principal features of the locks in the Welland Canal are shown in Table 4 below.

TABLE 4 PRINCIPAL FEATURES OF THE WELLAND CANAL LOCKS	
Principal Features	All Eight Locks
	Canadian
Opened to Commerce	1932
Width, feet	80
Length between mitre sill, feet	766
Depth over mitre sill, feet	30
Lift, feet	46.5 (1)
Note: 1. Lift for locks 1 through 7; variable lift Lock 8, normally less than 3 feet.	

St. Lawrence River Locks. There are seven locks in the portion of the St Lawrence River between Lake Ontario and Montreal Quebec. The two American locks, Snell and Eisenhower are located near Massena, New York: and the remaining five locks are Canadian, the St. Lambert and Cote Ste. Catherine locks near Montreal Quebec; the Upper and Lower Beauharnois locks in the Beauharnois Power Canal and the Iroquois lock near Iroquois, Ontario. The principal features of the locks in the St Lawrence River are shown in Table 5 below.

TABLE 5 PRINCIPAL FEATURES OF THE ST LAWRENCE RIVER LOCKS							
Principal Features	Lock						
	Canadian				U.S.		Canadian
	St. Lambert	Cote Ste. Catherine	Lower Beauharnois	Upper Beauharnois	Snell	Eisenhower	Iroquis
Opened to Commerce	1959	1959	1959	1959	1959	1959	1959
Width, feet	80	80	80	80	80	80	80
Length between mitre sill, feet	766	766	766	766	766	766	766
Depth over mitre sill, feet	30	30	30	30	30	30	30
Lift, feet	22	37	42	40	49	42	6

Harbors

There are presently 63 commercial U.S. Federal harbors on the Great Lakes that received Federal assistance. The depths at these harbors range from 16 to 28 feet. In addition, there are 17 U.S. private deep-draft harbors in the Great Lakes system. Harbors in the study area are listed in Table 6.

There are 32 commercial harbors and 1 recreational harbor under review in this study. Three harbors, (Green Bay, WI Saugatuck, MI and Sheboygan, WI) sent letters requesting to be included in the study.

For detailed description of each harbor, refer to *Appendix B- Cost Engineering*.

Table 6
U. S. GREAT LAKES FEDERAL AND PRIVATE HARBORS

Federal		Private
Lake Superior	**Lake Michigan (cont'd)**	**Lake Superior**
Grand Marais, Minn.	Frankfort, Mich.	+ Taconite, Minn.
+ Two Harbors, Minn.	Charlevoix, Mich.	+ Silver Bay, Minn.
+ Duluth—Superior, Minn/Wis.		
Ashland, Wisconsin		**Lake Michigan**
Ontonagon, Mich.	**Lake Huron**	Oak Creek, Wis.
+ Presque Isle/,Marquette Mich.	+ Alpena, Mich.	Buffington, Ind.
Keweenaw Waterway, Mich.	Cheboygan, Mich.	+ Gary, Ind.
	+ Saginaw, Michigan	Port Dolomite, Mich.
Lake Michigan	Harbor Beach, Mich.	Port Inland, Mich.
+ Saugatuck, MI		+ Escanaba, Mich.
+ Menominee/Marinette, Mich/Wis.	+ St. Clair/Detroit Rivers	Petoskey Penn Dixie Harbor, Mich.
+ Green Bay, Wis.	Marysville, Mich.	
Sturgeon Bay, Wis.	Port of Detroit, Mich.	
Kewaunee, Wis.	+ Detroit River	**Lake Huron**
Two Rivers, Wis.	St. Clair	+ Calcite, Mich.
Manitowoc, Wis.	+ Rouge River	+ Stoneport, Mich.
+ Sheboygan, Wis.	+ Monroe, Mich.	Port Gypsum, Mich.
Port Washington, Wis.		Alabaster, Mich.
+ Milwaukee, Wis.	**Lake Erie**	+ Drummond Island, Mich.
Racine, Wis.	+ Toledo, Ohio	
Kenosha, Wis.	+ Sandusky, Ohio	**Lake Erie**
Waukegan, Ill.	Huron, Ohio	Marblehead, Ohio
+ Chicago, Ill.	+ Lorain, Ohio	
+ Calumet Harbor, Ind. & Ill. & Lake Calumet	+ Cleveland, Ohio	
+ Indiana Harbor, Ind.	+ Fairport, Ohio	
+ Burns Waterway, Ind.	+ Ashtabula, Ohio	
Michigan City, Ind.	+ Conneaut, Ohio	
St. Joseph, Mich.	Erie, Pa.	
South Haven, Mich.	+ Port of Buffalo, N.Y.	
Holland, Mich.		
Manistique, Mich.	**Lake Ontario**	
Gladstone, Mich.	Rochester, N.Y.	
Grand Haven, Mich.	Great Sodus Bay, N.Y.	
Muskegon, Mich.	Oswego, N.Y.	Legend + 33 harbors under review.
White Lake, Mich.	Ogdensburg, N.Y.	
Ludington, Mich.		
Manistee Harbor, Mich.		

(3). Social/Economic/Institutional Setting

The physical environment of the Great Lakes basin has exerted a strong influence over the distribution of population and types and distribution of economic activities. The single most significant resource of the basin is the five Great Lakes and connecting channels. In addition to abundant natural resources and large agricultural potential, this source of water has allowed a highly industrial and agricultural economic base to develop. The Great Lakes System comprises a navigation network between important industrial centers, agricultural production areas, and the heavily populated eastern market.

Population

The Great Lakes basin accounts for approximately 28.9% of the total U. S. population. The five largest metropolitan areas of Chicago, Detroit, Cleveland, Milwaukee, and Buffalo, account for a large portion of the regional population, which is approximately 18 million (Reference 2000 Census).

Employment and Labor Force

According to the Bureau of Economic Analysis (BEA), in the eight Great Lakes states of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin, approximately 47.2 million people were employed during 1999. Durable goods manufacturing were the second largest employment category, at over 14% of all employment in the region, it was surpassed only by services. Manufactured goods, paper, printing, foods, chemical and related products are other important products of the region. Chemical and allied products are expected to increase relative to the other sectors.

Earnings and Income

In 1999, earned income measured $1.7 trillion in the eight states bordering the Great Lakes. Historically, total personal income and per capita income within the eight state region has been higher than the national average. This can be attributed to a heavy concentration of industrial activity. Economic centers, which lead the basin in per capita income, are the metropolitan areas of Chicago, Illinois; Detroit, Michigan; Milwaukee, Wisconsin; and Rochester, New York.

Business and Industrial Activity

The Great Lakes area economy is heavily industrial, utilizing the transportation and power advantages offered by the Great Lakes-St. Lawrence River system. In addition, there is significant agricultural, mining and forestry production. Commercial fishing, historically one of the oldest activities, has declined in importance, although sport fishing has increased tremendously and is of great recreational importance to some regions.

Economic activity is greater and more intense in the United States portion of the basin. In the United States, more than one-fifth of the manufacturing employees, and capital expenditures, are within the Great Lakes basin. According to the BEA, the value of manufactured goods among the eight states was $529,995,000,000 for 1999. The region is the primary focus of the iron and steel industry in North America, accounting for over 50 percent of the U.S. production. The region also contains high proportions of other industries, including chemicals, paper, food products, machinery, transportation equipment and fabricated metal products. Mineral production is also important, particularly iron ore and limestone. The western Great Lakes area produces over two-thirds of the Nation's output of iron ore and one-twentieth of its domestic copper output and employ almost a half million persons.

Feed grains are grown in the basin both for local use in the livestock industry and for export. The basin is important for its dry bean production. "Hothouse" rhubarb, sugar beets, soft white wheat used in flour blending, and dairy farming are found throughout the region. Cash crops, such as corn, soybeans, and vegetables, dominate in the more productive southern portion. Due to the favorable climate along the lakes, one of the Nation's most important fruit and vegetable areas has developed. Forest resources continue to serve as a basis for economic development. Production of pulpwood, saw logs, veneer logs, and miscellaneous industrial timber products is substantial and is expected to increase.

Finally, the basin has a major recreation and tourist industry. The extensive sand beaches and scenic shorelines of the Great Lakes, with water related recreational opportunities, attract many users. Typical are the cottage and summer resort areas of northern Michigan; northeastern Wisconsin; Georgian Bay, Ontario; and the Thousand Islands reach of the St. Lawrence River. Major tourist attractions include the Soo Locks, Niagara Falls and the Welland Canal.

Travel and tourism in the Great Lakes basin generates many billions of dollars in expenditures and tax revenues each year. It is one of the top economic sectors in each of the Great Lakes states as well as in the province of Ontario. The U.S. Travel Data Center has calculated a total of $545 billion of travel-related expenditures in the U.S. for 2001 with a quarter of that amount attributed to the eight Great Lakes states. Coastal communities and state, provincial and national parks account for a growing share of travel activity. Economic impact is greatest during the summer travel season but for particular places "shoulder" and winter season tourism is expanding. Recreational boating reveals the strong connection between water resources and tourism and recreational activity. In 1999, 4.2 million recreational boats were registered in the Great Lakes States or one-third of the national total. Boat manufacturers and dealer payroll in the Great Lakes region coupled with retail related expenditures was $3 billion. With inclusion of Canadian boats, the Great Lakes Commission estimates that about 1.5 million boats operate on the Great Lakes each year. Boating and fishing are strongly connected and the Great Lakes Fishery Commission estimates that Great Lakes sport fishing accounts for a $4 billion impact.

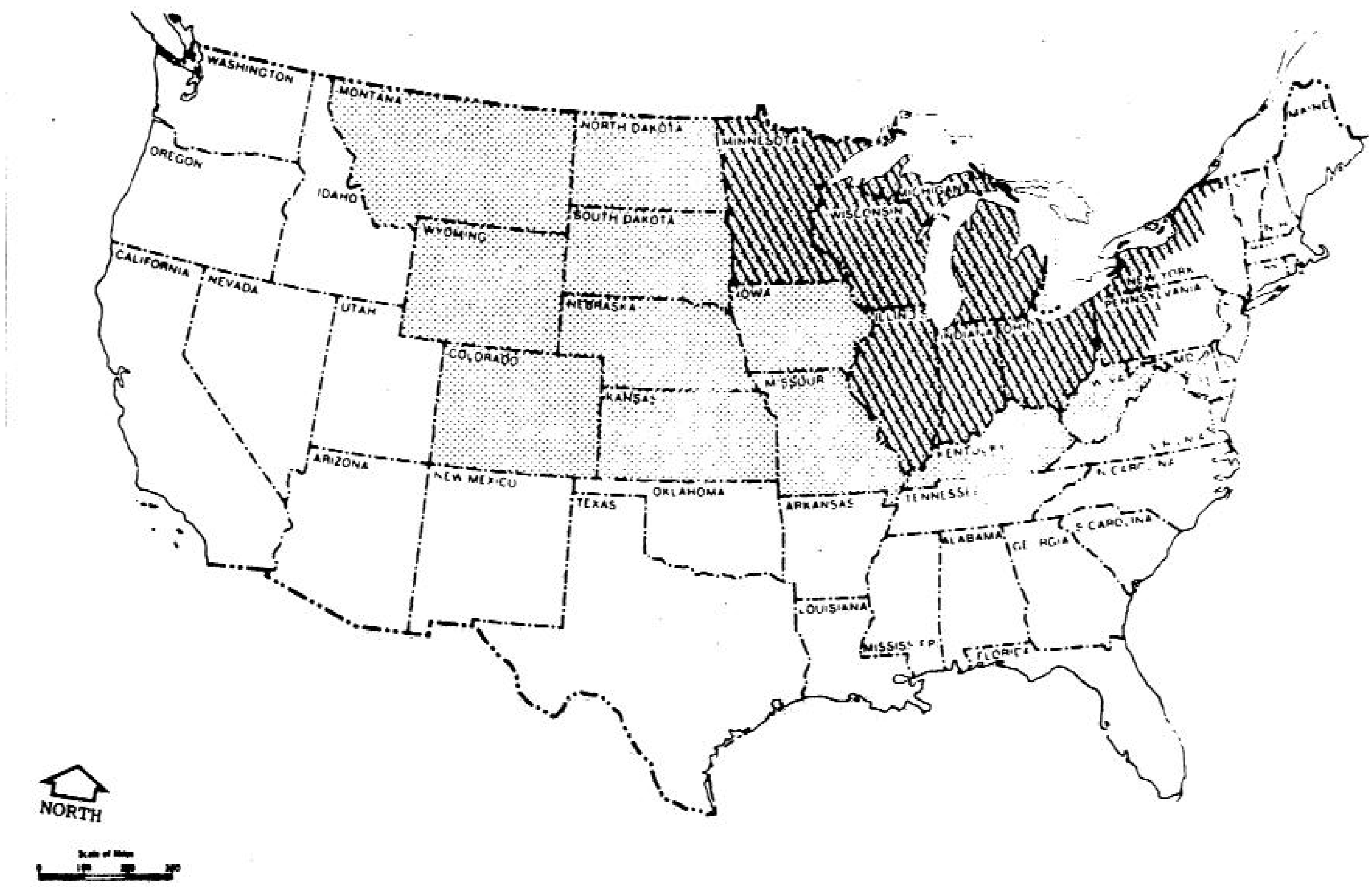
Commercial and Economic Tributary Area

The region within the United States considered to be a commercial and economic tributary to the Great Lakes for various types of commercial transportation includes the eight states bordering the Great Lakes (Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania, and New York) and the eleven contiguous states (Montana, Wyoming, Colorado, North Dakota, South Dakota, Nebraska, Kansas, Iowa, Missouri, Kentucky, and West Virginia). The Canadian provinces of Ontario and Quebec form the entire Canadian shoreline of the Great Lakes, as well as the north shore of the St. Lawrence River. The harbors on the Great Lakes are served by commercial transportation networks (railroads, highways, airways and pipelines) which link the area with other parts of the United States and Canada. Figure 2, on page 22, is an illustration of the Great Lakes Economic Region.

<u>Agriculture</u>

The region is agriculturally diverse and has a comparative advantage for specific types of agricultural production. A major dairy area is located in Wisconsin. Feed grain and livestock production is important in southern Michigan, Minnesota, Wisconsin, Ohio, Illinois, and Indiana. Commercial fruits and vegetables are important in areas of Wisconsin, Michigan and Ohio. Grain and timber production contributes to the economy of the northern portions of the region.

In 1997, the eight Great Lakes states had 97.59 million acres of cropland out of 265.7 million acres total land. Thus, cropland accounted for 36.73% of the total acres in 1997. Between 1992 and 1997, Minnesota and Pennsylvania both experienced slight increases in cropland while the remainder of the Great Lakes states experienced slight declines. Irrigated farmland is not now a significant portion of the agricultural farmland, nor is it projected to be in the future. Feed and food crops predominate among the major agricultural land use categories, followed by grazed forest and woodland, other crops, pasture, and graze land.



LEGEND

Eight Great Lakes Border States
19 State Economically Dependent Region
GREAT LAKES ECONOMIC REGION
Figure 1

Transportation

The region occupies a location strategic to the highly industrialized and well-populated north central United States and south central Canada, and is astride the transcontinental link between the major agricultural production regions of the west and midwest and the market areas of the east.

The region is considered tributary to Great Lakes Harbors for shipment of overseas general cargo. In the United States, it includes the eight Great Lakes states and eleven additional contiguous states which generate a significant amount of the U.S. general cargo export traffic.

Recreational

The Great Lakes Basin has 17.8 million acres of public recreational areas. There is a great diversity of outstanding natural features such as forests, meadows, marshes, shorelines, islands, streams and lakes (both Great Lakes and inland). Many of these areas have exceptional scenic, wilderness, and aesthetic qualities, which make them nationally significant. Recreational resources are not evenly distributed, being mostly located in the drainages of Lake Superior, Lake Ontario, and the northern parts of Lake Michigan.

Regional Growth

Urban and developed areas, while representing only about 10% of the total land area, total over 45% of the area of the lakes coastal counties. Many rural areas in the region are affected by economic and social factors in nearby urban centers. The urban influence on agricultural land-use may be even more dramatic in the future. In the region, more than one-third of the total cropland is located within Standard Metropolitan Statistical Areas, where most future urban growth is expected.

The problems and needs of urban and developed areas are serious and growing in scope and intensity. Many of the land-use problems are associated with the change from rural to urban. Zoning conflicts, taxation problems, land value appreciation, and accelerated erosion are commonly associated with urban growth. These problems are concentrated around existing urban areas where most of the future growth is expected; large areas of the region will experience the impact of urban expansion. The southern portion of the region and along the Great Lakes will be most affected.

e. Problems and Opportunities:

(1). Identified Problems:

Understanding the diverse problems, needs and existing conditions associated with the Great Lakes/St. Lawrence Seaway commercial navigation system and the economic, social and institutional systems that interact with it establishes a guide to the formulation of alternatives that address these problems and needs. While many of the problems and needs listed below vary in intensity according to geographic areas, there are two primary issues that form the basis for problem analysis in this study. These are the needs that arise from the commercial fleet's desire for economic optimization; and the potential impacts on the existing environmental, social and institutional systems that could result from those modifications necessary to meet the demands of the commercial fleet.

The problems and needs of the various systems can best be summarized by major navigational feature.

Commercial Navigation Problems

a. Capital investment required to accommodate larger vessels.
b. Maintenance costs.
c. Vessel size and its effect on transit of channels.
d. Safeguards to avoid spills of oil and other hazardous substances.
e. Navigation during fog, high winds, and ice congested channels.
f. Vessel traffic and speed control.
g. Historic and cultural resources.
h. Potential disruption of fish and wildlife habitat.
i. Operational training of vessel pilots.
j. Potential for increased shoreline damage.
k. Availability of sites for dredge material placement.
l. Potential bottom scouring.
m. Secondary employment effects of structural and non-structural improvements for waterborne transportation.
n. Potential recreational boating effects and associated recreation activities in the channels.
o. Potential social effects on channel residents.
p. Canadian participation and responsibility and cost sharing.
q. Acceptable vessel speeds.
r. Potential damage to shore structures.

Harbor Problems

a. Ramifications of vessel size in relation to vessel handling and control.
b. Operation of loading and unloading facilities.
c. Capital investment of others needed to handle larger vessels.
d. Potential shore erosion and shore structure damage.
e. Water quality, vessel waste discharge and turbidity.
f. Safeguards to avoid spills of oil and other hazardous substances.
g. Interfacing larger vessels with other transportation modes.
h. Adequate turning basins.
i. Potential bottom scouring.
j. Potential disruption of fish and wildlife habitat.
k. Potential air pollution.
l. First costs and the operation/maintenance costs of the modifications.
m. Potential effects on littoral transport, both on lakes and rivers.

Locks Problems

a. Relationship between existing and potential vessel sizes and existing facilities.
b. Capital investment requirements for necessary facilities to support and handle larger vessels.
c. Traffic control and service requirements.
d. Effects and constraints of additional locks.
e. Maintenance costs for modifications.
f. Determination of maximum lock size.
g. Safeguards to avoid disruption of service from accidents in critical areas.
h. Need for additional locks.
i. Potential social effects of modified or new lockage systems.
j. Potential economic impacts resulting from lock modification.
k. Potential disruption of fish and wildlife habitat.
l. Requirements and contingency plans to handle hazardous material transport.
m. Lock crew safety.
n. Potential effects on employment.
o. Water quality, vessel waste discharge and turbidity.
p. Potential effects on recreational boating and associated activities,
q. Canadian participation and responsibility.
r. Potential air pollution.
s. Navigation during fog and high winds.
t. Lock wall icing and lock approach ice congestion.

(2). Opportunities:

a. To utilize larger size vessels, through increasing lock capacity. Larger ships are more efficient in relation to their size and as such are able to transport more cargo at a reduced rate per ton.

b. To maximize utilization of existing vessel capacity, through increasing channel depth. Increased channel depth would increase the ship's ability to transport more cargo at a reduced rate per ton.

c. To improve shipping efficiency by improving services to receiving harbors/ports within the Great Lakes /St. Lawrence Seaway System.

d. To minimize potential losses of cultural and historic resources in the selection of the Base Plan.

e. To enhance aquatic habitat in the selection of the Base Plan.

(3). Expected Future without Project Conditions:

The future without-project condition for the Great Lakes Navigation System (GLNS) assumes construction of a new Poe-sized lock at the current site of the Davis and Sabin locks, while maintaining the status quo elsewhere on the U.S. portion of the GLNS. The Soo Locks are defined as four parallel locks, located on the St. Marys River, at Sault Ste. Marie, Michigan. On the U.S.

portion of the GLNS a minimum draft of 25'6" LWD at all locks and connecting channels is maintained over the next 70 years. On the Seaway, a 26'3" draft is maintained. The aging Seaway locks are first maintained through normal O&M, then limited rehabilitation, and ultimately major rehabilitation. Each successively more aggressive approach to maintenance is phased in as the condition of Seaway locks deteriorates, requiring longer closures, which through time begin to occur during the navigation season, sometimes without advance notice to shippers. The single lock configuration in most locations makes the reliability of the overall system an even greater concern than it might be for dual-lock systems. The consequences of a major lock failure likely would cause traffic disruptions of the entire waterway.

The locks on the Welland Canal are at least seventy years old, while the locks on the Montreal/Lake Ontario (MLO) portion are forty-four years old. Maintaining the locks will likely result in repairs that address immediate concerns, however, these repairs may not be sufficient in scope to deal with the underlying structural problems. A comprehensive program with major expenses in lock rehabilitation will have to be initiated to keep the locks functional. Before a decision is made to make investments of this magnitude, an analysis should be completed to determine if it makes economic sense to rehabilitate the locks versus building new locks. Ultimately, the locks may face closure if a wide-ranging program to rebuild or repair the locks is not initiated.

With respect to the individual ports and harbors, the future without-project condition will be to maintain the existing project depths in the channels through ordinary operations and maintenance

f. Planning Objectives:

A set of planning objectives have also been formulated based upon the water and related resource management problems, needs and opportunities identified for the Great Lakes region. The objectives listed below contribute to both the national and regional objectives for the economic life of the project.

(1). Contribute to the development and efficient utilization of the Great Lakes/St. Lawrence Seaway commercial navigation system infrastructure;

(2). Contribute to an increase in output of goods, services and external economics of the Great Lakes/St. Lawrence Seaway system;

(3). Contribute to the maintenance of existing water levels and flows for the Great Lakes; and

(4). Contribute to the quality of the Great Lakes/St. Lawrence Seaway environment, giving particular attention to the ecosystem and water quality of the lakes.

g. Planning Constraints:

Planning constraints are the technical, environmental, social, economic and institutional limitations within which the proposed alternative plans would be implemented. These include resources limitations, potential competitive use of scarce resources and legislative or regulatory restrictions. Planning constraints define the scope of alternatives plans formulated. Constraints identified during the development of this study include:

(1). The technical limits for vessel size in terms of draft, beam, and length;

(2). The effects of larger vessels on existing port development;

(3). The dependence or independence of betterment's on the Upper Great Lakes to betterment's on the St. Lawrence River System

(4). The availability of suitable sites to provide for dredge material placement during construction and maintenance;

(5). and the legal and international aspects of enacting modifications.

h. Management Measures to Address Identified Planning Objectives:

A management measure is a feature or activity at a site, which addresses one or more of the planning objectives. In analysis of data and discussion with navigation interests, a wide variety of measures were considered, some of which were found to be infeasible due to technical, economic, or environmental constraints. Each measure was assessed and a determination made regarding whether it should be retained in the formulation of alternative plans. The description of the measures considered in this study are presented below:

(1). No Action. The Corps is required to consider the option of "No Action" as one of the alternatives in order to comply with the requirements of the National Environmental Policy Act (NEPA). No action assumes that no project would be implemented by the Federal Government or by local interests to achieve the planning objectives. No Action, which is synonymous with Without Project Condition, forms the basis from which all other plans are measured.

(2). Structural. Structural measures considered in this study include: Deepening the Great Lakes Connecting Channels, increasing capacity to the St. Lawrence Seaway, Deepening Individual Ports; and decrease Navigational Restrictions. See Section, i. Alternative Plans for a detailed description of the structural measures.

(3). Non-Structural. Non-structural measures considered in this study include: Increased Water Level Data Access, and Aids to Navigation, which would increase the operating efficiency of the navigation system. A detailed description of the non-structural measures is discussed below.

i. Alternative Plans**:**

(1). **No Action (Without project conditions)** See *Expected Future without Project Conditions* on page 25 for a detailed discussion.

(2). **Deepening the Great Lakes Connecting Channels**

This alternative proposes to evaluate potential betterments to the Great Lakes Connecting Channels to include: modifications to improve existing infrastructure and modifications to the existing channels to accommodate deeper draft vessel traffic. The current minimum, safe vessel depth for the navigation system is 25' 6" at Low Water Datum (LWD). Evaluation of deepening of the channel would include incremental depths from 25' 6" LWD to 35 feet LWD.

(3). **Improvements to the St. Lawrence Seaway**

This alternative proposes to evaluate potential betterments to the St. Lawrence Seaway to include: optimizing the navigation season, modifications to the existing channel to accommodate two way traffic, modifications to the existing channels to accommodate deeper draft, and lock expansion. The current minimum, safe vessel depth for the navigation system is 26'- 3" at Low Water Datum (LWD). Evaluation of deepening of the channel would include incremental depths from 26' – 3" LWD to 35 feet LWD.

(4). **Deepening Individual Ports**

This alternative proposes to evaluate potential betterments to the ports and harbors within the Great Lakes System to include: modifications to improve existing infrastructure and modifications to the existing channels to accommodate deeper draft vessel traffic. The current minimum, safe vessel depth for the navigation system is 25' 6" at Low Water Datum (LWD). Evaluation of deepening of the channel would include incremental depths from 25' 6" LWD to 35 feet LWD.

(5). **Navigational Restrictions**

a. **Chicago Sanitary & Ship Canal**

This alternative proposes to evaluate potential improvements to the waterborne trade between the Great Lakes and the Mississippi River through the Illinois Waterway. There are about 8,500 river barges operating through the Cal-Sag Channel and the Chicago Sanitary and Ship Canal to the several major ports, Burns Harbor and Indiana Harbor in Indiana and Calumet and Chicago Harbor in Illinois. These ports are served by barge on a year round basis and connect Inland Waterway destinations/origins providing a water mode service for Seaway commodities as well as domestic commodities. The Illinois Waterway barge traffic generally carries between 42 and 50 millions tons of cargo each year. This route has infrastructure limitations such as low bridge air draft, narrow channel and high traffic volume.

The Chicago Sanitary and Ship Canal channel from its junction with the Cal-Sag Channel (river mile 303.5) to its junction with the Des Plaines River (river mile 290) has significant barge congestion. The channel is approximately 160 feet wide through this area. Increasing the channel width would have a significant benefit to improve navigation between the Illinois Waterway and the Great Lakes.

There are also two bridges that restrict barge traffic on the Chicago Sanitary and Ship Canal. The railroad bridge in Lemont Illinois at river mile 300.5 only has a clearance of 19.1 feet. The bridge is a bascule bridge that is inoperable. The second railroad bridge in Chicago at river mile 320.4 only has a clearance of 17 feet. The bridge is also a bascule bridge that is also inoperable. Modifications to these bridges to make them operable would have significant benefits to navigation. This alternative would evaluate improvements to the infrastructure to include: modifications to the existing railroad bridges and modifications to the existing channel to accommodate traffic volume.

b. **St. Clair River Ice Boom**

This alternative proposes to evaluate potential improvements to the St. Clair River within the Great Lakes system. Navigation on the middle lakes of the Great Lakes can occur all year depending on winter conditions. Ice formation and breakup on the lakes and in the rivers can cause delays to navigation interests and flooding problems for riparian properties. One of the most problematic areas is the St. Clair River and its many channeled delta, and the jamming of large ice floes from Lake Huron. The problem could be reduced by the proper placement of an ice retaining boom across the head of the river. Ice booms have been found to be quite effective in controlling the movement of ice in the St. Marys River, in Lake Erie at the Niagara River, and in the St. Lawrence Seaway.

Previous studies have been conducted on the installation of an ice boom at the head of the St. Clair River. These studies have provided details on the location of the boom, its costs, and its benefits. Problems previously identified with ice jams in the river include: delays to navigation due to vessels stuck in the ice in the navigation channel; scouring of the river bottom; and flooding of shore property. The installation of an ice boom at the head of the St. Clair River would improve the hydraulic efficiency of the river, allowing it to pass more water during winter season, thereby providing some means to reduce water levels on the upper Great Lakes during periods of high water.

(6). **Improved Water Level Data Access**

This alternative proposes to evaluate potential improvements to the water level data access within the Great Lakes system. An integral part of navigation of the Great Lakes, their connecting channels and the St. Lawrence River is a knowledge of past, current and forecasted water levels. These data are collected and disseminated by a variety of agencies in several ways. Improvements in access to these data by the navigation interests and some additional equipment installations could provide benefits to the navigation industry and improved safety to the Great Lakes, their connecting channels and the St. Lawrence River.

Currently, real-time water level data are collected by the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Army Corps of Engineers (USACE) in the U.S. and the Marine Environmental Data Service (MEDS) in Canada. Data are displayed at three different web sites, in different formats. Some data are available for instantaneous access by telephone to the gages directly. Some data are provided in elevation referenced to the International Great Lakes Datum of 1985 (IGLD 1985), while some data are provided as inches or centimeters above or below low water datum (LWD). Some data are provided in graphic format, showing the past three hours, the past 7 days or the past month. The inconsistency in access and presentation of these data can lead to misunderstanding of the current water level conditions throughout the system and therefore under utilization of commercial navigation capacity, or possibly safety problems from groundings.

The proposal is to work with all agencies supplying water level information to coordinate one consistent access point for all water level data. Information would be displayed for specific regions regardless of the ownership of the data, although proper credit and notations would be provided. Graphics will be consistent to show past information along with the current data, as past trends in water level changes are important future indicators. All data would be available in tabular format as well with elevations referenced to both IGLD 1985 and LWD. Other data needs and dissemination issues important to the navigation interests would be explored and incorporated if possible.

Additional equipment may also be necessary. The ability of the navigation interests to obtain real-time water level data can be important. As storms and other disturbances occur, water levels can change rapidly. Voice announcing capability at many of the gages would give the navigation interests the immediate current water level information they require during critical events. This would require the purchase of additional equipment and the installation of additional phone lines in order to provide this service while not compromising the operation of the water level gage itself. Operations and maintenance would then be required for any installations to ensure their operability and replace outdated equipment

(7). **Aids to Navigation**

This alternative proposes to evaluate potential improvements to the Great Lakes system through replacing buoys with permanent beacons. Great Lakes waterways are currently marked mostly by lighted buoys which must be removed in the fall prior to the onset of ice, and reset in the spring after the thaw, even though commercial shipping extends several weeks past the fall withdrawals, and starts well before buoys can be placed in the spring. This practice increases risk to mariners and costs to shippers. The Coast Guard envisions a system in which ice resistant structures replace a greater number of buoys. Such aids to navigation system would be more robust by providing more reliable aids and year round service. Selection of beacon placement and numbers could be determined through use of a virtual vessel simulation model. Although ice resistant structures are expensive (several hundred thousand dollars, varying with depth and bottom conditions), we believe the taxpayer would see a positive return on investment through reduced servicing costs alone.

j. Preliminary Screening of Alternative Plans**:**

Preliminary plans are comprised of one or more management measures that survived initial screening. The description and results of the evaluations of the preliminary plans that were considered in this study are now presented:

(1). No Action (Without project conditions) See *Expected Future without Project Conditions* on page 26 for a detailed discussion.

(2). Deepening the Great Lakes Connecting Channels

Connecting channel deepening is based on considering the connecting channels as constraint points in a vessel origin-destination route from port to port. Once the vessel's origin-destination route was identified, the constraint points on the route could be identified. The constraint points included Vidal Shoals (located upstream of Soo locks), the St. Marys River Little Rapids, the Straits of Mackinac, the St. Clair River, Lake St. Clair, and the Detroit River. Next, the maximum ship draft that could be accommodated at the origin port, destination port and all the affected constraint points was determined. Potential draft is defined as the average water column available at a port or node, minus an underkeel clearance of one foot. These potential drafts were calculated from 101 years of water level data - 1900 to 2000, for all the origin ports, destination ports and constraint points. This information was compared to the fleet's maximum ship draft to determine various deepening plans. Deepening plans are discussed in detail in the Economic Appendix, *SECTION 7 ALTERNATIVE FUTURE PLANS*.

For example, consider iron ore moving from a Lake Michigan port (Escanaba, draft 28.5) to a Lake Erie port (Ashtabula Harbor, draft 29.5). Ashtabula Harbor could generate iron ore benefits for potential draft deepening to 29.5 feet, however, to get to Ashtabula, vessels have to travel through the St. Clair River (draft 28.2)/Lake St. Clair/Detroit River. Deepening beyond 28.2 feet would necessitate deepening the St. Clair River (Constraint Point). Deepening beyond 28.7 feet would involve deepening the St. Clair River and Lake St. Clair.

Economic benefits for deepening connecting channels were evaluated in combination with harbors and ports and Seaway replacement locks under the five broad options described below. Due to scheduling and funding limitations, drafts up to 30' and at 35' were evaluated for the connecting channels and ports.

Option 1 - Includes the many combinations of improvement alternatives for the Great Lakes connecting channels and harbors (drafts up to 30 ft) combined with eventual replacement of the Seaway locks.

Option 2 - Contemplates the same improvements as Option 1 above, coupled with construction of a deeper (35' draft) and larger (110'x1200' lock chambers) Welland Canal.

Option 3 - Builds upon Option 2 by replacing the MLO Section of the Seaway with a deeper and larger system of locks and channels, and by extending the 35' draft system up to Detroit.

Option 4 - Is the same as Option 3, except that the 35’ draft now extends into Lake Michigan and Lake Huron by the deepening of the entire St. Clair-Detroit River system.

Option 5 - Extends the 35’ draft throughout the GLSLS system as a result of deepening the St. Marys River and lowering the sill depth of the Soo locks.

With regards to deepening the Great Lakes connecting channels to a 30’ draft, the GLLAST model was run for a condition where vessels can draft to their maximum depth. See description of option 1 on page 31. As a result of the study, using year 2000 traffic levels, it was determined that the estimated cost reduction for existing movements would be $87 million annually. This estimate acts to represent the benefits of having the ability to draft 30’ throughout the Great Lakes connecting channels and ports. The benefits for Option 1 with a 30’ draft is discussed in detail in the Economic Appendix, *SECTION 8, ECONOMIC EVALUATION FINAL ALTERNATIVE,* Section 2(d). Port deepening and channel deepening plans were developed jointly for evaluation of Option 1. All but one plan carried forward to final screening for Option 1 showed positive net benefits. The results are summarized in Table 8-2.

With regards to channel deepening to 35 ft draft, under options 3, 4, & 5, the potential annual benefits are combined with lock replacements. The results of the combined benefits are the following; Option 3, a 35 ft draft channel deepening up to Detroit, a 30 ft draft Great Lakes connecting channels and ports in combination with seaway replacement locks ($885,000,000 annually), Option 4, a 35 ft draft channel up to Lake Huron and Lake Michigan and a 30 ft draft connecting channels and ports in combination with seaway replacement locks ($1,417,000,000 annually), and Option 5, a 35’ draft channel throughout the Great Lakes and St Lawrence Seaway system in combination with seaway replacement locks ($1,510,000,000 annually).

The economic development benefits of a 35 ft draft system throughout were estimated using the Maritime Input-Output (MIO) model. See Appendix A Economic Analysis, Attachment 5 for details of the MIO model. The benefits for Options 3, 4, & 5 with a 35 ft draft are discussed in detail in the Appendix A- Economic Analysis, *SECTION 8, ECONOMIC EVALUATION FINAL ALTERNATIVE,* Sections 3, 4, & 5.

Based on the potential net benefits generated from deepening the connecting channels in conjunction with associated ports and harbors, it is therefore recommended that this alternative be carried forward into feasibility for further analysis.

(3). Improvements to the St. Lawrence Seaway

The economic benefits for Improvements to the St. Lawrence Seaway, were evaluated in combination with harbors and ports and channel deepening under the five broad options, described on page 31. Options 3, 4, & 5 include construction of a deeper (35' draft) and larger locks (110' x 1200' lock chambers) for the Welland canal section and the MLO section of the seaway. See Deepening the Great Lakes Connecting Channels on page 31 for discussion of combined benefits. The benefits for Option 3, 4, & 5 with a 35 ft draft are discussed in detail in the Economic Appendix, *SECTION 8, ECONOMIC EVALUATION FINAL ALTERNATIVE,* Sections 3, 4, & 5.

No costs have been developed for the without-project condition on the St. Lawrence Seaway. Because lock reliability is a concern on the Seaway, a complete description and evaluation of the without-project condition alternatives is an especially important, analytically intensive effort. Completing the requisite engineering surveys, analyses, designs, and cost estimates for the 15-lock Seaway system (including tunnels and bridges) is beyond the scope of this reconnaissance study. The cost of modifying the locks and channels on the Seaway to accommodate Panamax size vessels may be in the magnitude of $10 billion. There would also be additional costs associated with landside infrastructure improvements and crossings.

Based on the potential benefits generated (up to $1,510,000,000 annually under option 5) for seaway modifications, compared with the potential costs of the proposed improvements, it is recommended that this alternative be carried forward into feasibility for further analysis.

(4). Deepening Individual Ports

Benefits for connecting channels and ports are based on U.S. domestic traffic and a portion of U.S. foreign traffic. These benefits, along with costs are the basis of the benefit-cost analysis, which indicate whether there is federal interest. Benefits for the ports are estimated using a vessel-costing model. Costs were estimated for deepening connecting channels and port plans. The level of detail to which the cost estimates were developed varies from port to port and also between the connecting channels. The level of detail was dependent upon availability of existing data from past studies, accessibility of recent condition surveys, and availability of existing data for non-Federal ports. Schedule and funding constraints limited the extent to which previous cost estimates could be refined based on more current data and operational conditions at each port. Where minimal or no data was readily available for a specific port, cost estimates were based on costs for ports in close proximity with similar harbor configuration. As a result, a range of cost estimates was established in order to better reflect these uncertainties. In all cases, however, the same general methodology is employed in estimating the cost of improvements at all GLNS harbors and channels.

Port deepening and connecting channel deepening plans were developed jointly for the four upper Great Lakes: Superior, Michigan, Huron and Erie. See Economic Appendix, *SECTION 7, ALTERNATIVE FUTURE PLANS*, for a detailed discussion of plans for each port or harbor.

A number of parameters affect the feasibility of harbor deepening. Some of these factors are: tonnage handled, origin-destination route distance, approach channel length, the existing fleet's capability to draft deeper, the destination port's draft relative to the origin port, and the connecting channel draft. Since benefits are measured as reduced transportation costs, harbors handling large tonnage with fleets that can take advantage of additional draft have the potential to generate enough benefits to justify deepening.

For example, consider iron ore moving from a Lake Superior port to a Lake Michigan port. Assume the origin port is shallower than the destination port, and there is a connecting channel constraint in the St. Marys River at Little Rapids. The deepening plan would allow the origin port to be deepened until the maximum ship draft allowed at the origin port equaled the maximum ship draft allowed at Little Rapids, assuming the vessels could utilize this additional draft.

Based upon the above criteria, a number of screening procedures were developed to identify harbors that have potential for deepening. The first screening was by tonnage, all ports that ship or receive over 1 million tons per year. These ports could be grouped by geographical area: the iron ore and coal- shipping ports of Lake Superior, the iron ore receiving and coal shipping ports located on Lake Erie, and the iron ore movements taking place between ports located on Lake Michigan. Lake Superior iron ore shipping ports include: Duluth, MN; Presque Isle, MI; Silver Bay, MN; Superior, WI; Taconite Harbor, MN; and Two Harbors, MN. Major Lake Erie ports include Toledo Harbor, Sandusky, Lorain, Cleveland, Ashtabula and Conneaut Harbor, all in Ohio. Finally, a number of ports that have large tonnages moving on the same body of water were identified: iron ore shipments from Escanaba, MI, coal shipments from Sandusky, OH and limestone shipments from various Lake Huron ports. A short list of 26 harbors was developed.

Table 7
Preliminary List of Harbor Deepening Candidates

Port/Harbor	Port/Harbor	Port/Harbor
1. Superior, WI	10. Detroit, MI	20. Alpena, MI
2. Indiana Harbor, IN	11. Calumet Harbor, IL	21. Lorain, OH
3. Dearborn, MI	12. Taconite, MN	22. Cleveland, OH
4. Escanaba, MI	13. Silver Bay, MN	23. Ashtabula, OH
5. St.Clair, MI	14. Two Harbors, MN	24. Conneaut, OH
6. Duluth, MN	15. Presque Isle\Marquette, MI	25. Fairport, OH
7. Saginaw, MI	16. Gary, IN	26. Toledo, OH
8. Monroe Harbor, MI	17. Burns Harbor, IN	
9. Sandusky Harbor, OH	18. Calcite, MI	

As a result of the economic analysis various ports and harbors show net positive benefits for deepening at various depths. The following table provides a list of ports/harbors which show a positive net benefit to cost ratio (BCR). See *SECTION 8, ECONOMIC EVALUATION FINAL ALTERNATIVE, Section 2(b)* for a detailed discussion.

Table 8 Summary of Economic Evaluation of Ports			
Port/Harbor	BCR	Port/Harbor	BCR
Sandusky, OH 0.5’	5.7	Drummond Island, MI 2.5’	1.8
Sandusky, OH 1.0’	6.1	Indiana Harbor, IN 1.0’	6.2
Sandusky, OH 1.5’	4.3	Indiana Harbor, IN 2.0’ & Escanaba, MI 1.0’	1.8
Sandusky, OH 2.0’	3.4	Calumet Harbor, 1.0’ for coal	3.0
Sandusky, OH w/vessel change *	97.9	Presque Isle, MI 0.5’	2.4
Ashtabula, OH 0.5	0.6	Duluth-Superior, MN 0.5’	10.7
Ashtabula, OH w/vessel change *	111.3	Duluth-Superior, MN 1.0’	5.3
Fairport, OH 1.0 w/vessel change +M tons**	36.2	Two Harbors, MN 0.5’	44.6
Fairport, OH 1.0 w/vessel change *	28.8	Two Harbors, MN 0.5’ & St. Marys River 1.0’	0.9
Calcite, MI 0.5’	1.4	Six Harbors Include: Duluth 1.5’, Presque Isle 1.5’, Silver Bay 1.5’, Superior 1.5’, Taconite 1.5’, Two Harbors 1.5’ & St. Marys River 1.0’,	1.7
Calcite, MI 1.0’	1.2	St Clair Harbor, MI 5.0’	16.9
Calcite, MI 1.5’	1.5		
Calcite, MI 2.0’	1.6	Dearborn, MI (Rouge River) 0.5’	9.5
Stoneport, MI 0.5’	1.2	Dearborn, MI (Rouge River) 1.5’	9.2
Stoneport, MI 1.0’	1.1	Dearborn, MI (Rouge River) 2.5’	8.7
Stoneport, MI 1.5’	1.2	Dearborn, MI (Rouge River) 3.0’	17.0
Stoneport, MI 2.0’	1.2	Dearborn, MI (Rouge River) 6.0’	9.2
* plans allow for vessel changes in response to harbor deepening ** additional 1 M tons of limestone			

Based on the potential net benefits generated (see net benefits above) it is recommended to carry all the deepening plans forward.

(5). <u>Navigational Restrictions</u>

a. Chicago Sanitary & Ship Canal

As a result of the study, four plans were developed to deal with traffic congestion that delays tows and increases safety concerns along the Lemont reach of the Chicago Sanitary and Ship Canal (CSSC). The inadequacy of fleeting areas is a major contributing factor in most instances. Low bridge clearances, specifically the Lemont-Railroad bridge, also impose time penalties and risks on commercial users. Plan CSSC 1, Quarry Site, takes advantage of an existing quarry site to provide additional fleeting. Plan CSSC 2, Three Mile Wall, proposes opening to fleeting a three mile stretch of the Cal-Sag Channel (CSC) located a few miles from the primary congestion point on the CSSC. Plan CSSC 3, Canal Widening, proposes widening a reach on the CSSC some miles distant from the Lemont-Railroad bridge, but away from the CSSC and CSC junction. The final plan is CSSC 4, Re-operation of the Lemont-Railroad Bridge. This plan would repair and replace the machinery necessary to reactivate the swing mechanism of the low-clearance, Lemont-Railroad Bridge. Each is discussed in more detail in *Appendix D- Chicago Sanitary and Ship Canal* and *Appendix A-Economic*

Analysis, Section 7 and Attachment 6.

All benefit estimates are based upon reducing transit times through the Lemont reach of the Chicago Sanitary and Ship Canal (CSSC). It is emphasized that these benefit estimates are not comprehensive as they do not account for savings attributable to reduced damage to property and life that would likely result from the proposed improvements.

A complete benefit-cost analysis was possible for just two of the four plans. No cost estimate is available for Plan CSSC1, Quarry Site or for Plan CSSC 3, Canal Widening. Cost estimates for Plan CSSC 2 and Plan CSSC 4, Three Mile Wall and Lemont Bridge are incomplete, as they do not include lands, easements, relocations and rights of way. This deficiency is accounted for through a fifty percent contingency. The cost estimate available for re-operation of the Lemont RR Bridge is $3,016,000. The cost estimate for mooring piers along one mile of the Three Mile Wall is $1,208,000, expanding this estimate out to the 2.8 miles of wall not yet being used increases the total cost to $3,381,000.

The annualized available cost estimates, at the discount rate of FY01 0.06375, over a 50 year project life, are $225,820 for the Three Mile Wall and $201,436 for the Lemont RR bridge Available quantified benefit estimates for these two plans are $284,000 and $34,000, respectively. The resultant benefit and cost ratio for these two plans are 1.38 and 0.17, respectively. See Table 9 on page 36.

Table 9
Summary of Average Annual Benefits by Category
Chicago Sanitary and Ship Canal Plans

Alternative	**BCR**
CSSC 1, Quarry site	n.a
CSSC 2, Three mile wall	1.26
CSSC 3, Canal widening	n.a.
CSSC 4, Lemont RR bridge	0.17

Based on the discussion on the previous page, it is apparent that a least one solution for providing navigation improvements in the CSSC would produce substantial economic benefits and that those benefits would likely exceed costs. Since navigation is a high priority in Administration budgeting, there is a strong Federal interest in conducting a feasibility study of the Chicago Sanitary and Ship Canal navigation improvements.

Based on this analysis, there are sufficient indications that a viable and implementable plan can be developed that will meet the necessary Federal interest criteria. It is recommended Chicago District proceed to the feasibility phase on the Chicago Sanitary and Ship Canal navigation improvements.

b. St. Clair River Ice Boom

Ice Booms. Navigation on the middle lakes of the Great Lakes can occur all year depending on winter conditions. Ice formation and breakup on the lakes and in the rivers can cause delays to navigation interests and flooding problems for riparian properties. The St. Clair and Detroit rivers are problematic areas with their many-channeled delta, and the jamming of large ice floes from lakes Huron and St. Clair. The ice problems could be reduced by the proper placement of ice-retaining booms across the headwaters of the rivers. Ice booms have been found to be quite effective in controlling the movement of ice in the St. Mary's River, the Niagara River and in the St. Lawrence Seaway.

Previous studies conducted on the installation of ice booms at the heads of the St. Clair and Detroit Rivers provide details on the location of the booms and their costs. Problems previously identified with ice jams in the rivers include: delays to navigation due to vessels stuck in the ice in the navigation channel; scouring of the river bottom; and flooding and other damage to shore property.

The brief outline presented here relies heavily on information obtained from a report generated in March of 1995, *Analysis of Great Lakes Icebreaking Requirements, Final Report, prepared by the U.S. Department of Transportation for the U.S. Coast Guard*. This report determines Federal and user requirements, reviews icebreaker capabilities and operating costs and historical ice conditions, and presents a benefit-cost ratio for the overall icebreaking program. In the course of achieving this end, the referenced report developed a cost model for the steel industry looking at alternatives such as stock piling and alternate modes of transportation. The frequent references to the "ice season" on the Great Lakes involve the months December through March. Ice boom costs were adjusted from the 1974 Navigation Season Extension report.

A cost summary of the annual cost of ice-breaking vessels and the annual cost of the proposed ice booms is shown in Table 10. The ice booms offer an annual cost savings (net benefits) of $251,900, the difference between the vessels annual cost ($1,425,900) and the ice-boom annual cost ($1,174,000). See *"Appendix A-Economic Analysis, Attachment 8, St Clair Ice Boom Alternative Analysis"* for a detailed discussion.

TABLE 10
Benefits and Cost of ice removal

Current Annual Cost of Ice Removal Attributable to St Clair-Detroit River System	$1,425,906
Proposed Annual Cost of Ice Booms	$1,174,000
Annual Cost Difference (Net Benefits)	$251,906

The direct Federal savings through decreased annual expenditures by the Coast Guard has not been exactly quantified since there has been no estimate as to the elimination of the need for icebreakers. If the need for icebreakers were eliminated, the benefit to the government would be equal to the difference in cost between the two alternatives of $250,000.

The accuracy of the cost of ice boom construction is questionable since these costs were merely adjusted to current dollars from a report completed in 1974 and technological advances could significantly affect the results. Whether updated costs would increase or decrease the bottom line is uncertain. Technological advances may decrease the cost of construction by advancing our ability to produce the same product cheaper or may increase it by design improvements that increase efficiency along with costs. In addition, environmental considerations could potentially have a significant impact on the cost.

The benefits accrued to shipping are calculated from a much more recent, thorough report. Further study is required to determine the difference in the benefits between the current use of icebreakers and the possible use of ice booms. In order to make a reasonable comparison between these alternatives, it is also necessary to estimate the continued need, if any, for icebreakers after the installation of the ice booms.

This review of the available information indicates that placing ice booms in the St. Clair-Detroit River system has the potential for federal savings and further study is warranted.

(6). Improved Water Level Data Access:

a). General

Real-time water level data are collected by the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Army Corps of Engineers (USACE) in the U.S. and the Marine Environmental Data Service (MEDS) in Canada. The inconsistency in access and presentation of these data can lead to misunderstanding of the current water level conditions throughout the system and therefore under utilization of commercial navigation capacity, or possible safety problems from grounding.

1) National Oceanic and Atmospheric Administration

The National Oceanic and Atmospheric Administration (NOAA) has 45 gages in place on the Great Lakes and St. Lawrence River system.

NOAA has installed a Lite Physical Oceanographic Real-Time System (PORTS) at Sault Ste. Marie, Michigan at the S.W. Pier and at U.S. Slip stations. This system provides real-time 6-minute water level readouts to the lock operators, who in turn relay them to ships in the area. The Data are also posted to a web site accessible by anyone with Internet access. The web site shows plots of the last three hours of data to indicate recent trends in water level fluctuations at the site. The disadvantage is that this information is only accessible through the Internet. Proposed upgrade for a full PORTS system at Sault Ste. Marie would cost approximately $50,000 for a full range of equipment, backup systems and meteorologic sensors. Annual operations and maintenance costs would be approximately $7,000.

2) The United States Army Corps of Engineers

The Detroit District of the U.S. Army Corps of Engineers (USACE) has 16 gages in place on the Great Lakes and St. Lawrence River system.

USACE has installed a voice modem at the Rock Cut gage site on the lower St. Marys River. This gage can be accessed by telephone giving the user the instantaneous water level. An advantage to this mode is the availability to anyone with a telephone. The disadvantage is that the user receives only one water level reading so there is no comparison for accuracy. A system of this type would cost approximately $5,000 individually and would achieve some economies of scale with multiple simultaneous installations. Annual operations costs would consist of maintaining telephone service at a cost of approximately $300 per site. Additionally, provisions would need to be made for replacement equipment, for repairs or eventual complete replacement.

3) Marine Environment Data Services

The Marine Environment Data Services (MEDS) has 33 gages in place in the Canadian waters of the Great Lakes and St. Lawrence River System.

b) Combined Water level access level data

The results of the study propose to coordinate one consistent access point for all water level data through working with all entities currently generating water level information, such as NOAA, MEDS, USACE, hydropower entities, and any other data source known. This central access point involves the creation of a new web site to represent all water level data in the Great Lakes in a consistent fashion. Information would then be displayed for specific regions, regardless of the ownership of the data, providing proper credit and notations. Graphics will be consistent to show past and current information, as past trends in water level changes are important future indicators. Coordination with navigation interests is considered critical to ensure that the users needs are being met with the web site.

The data would be available in the following formats:

- English and Metric units
- Referenced to feet/meters IGLD 1985
- Referenced to inches/cm above/below low water datum
- Tabular and graphic formats
- Detailed data for the most recent several hours
- Data for the most recent few days
- Data for the most recent month
- Historical data as available

The estimated development time for the web site, tables, and graphs is 6 months. This would necessarily include automated updating of the data and some scrutiny of errors. It is expected that the maintenance of the site would take approximately 2 hours per day. Maintenance of both the equipment and software would be required along with planning for eventual replacement.

c) Costs

The estimated total first cost of the proposed web site development is approximately $60,000. The life of the project is assumed 20 years for discounting the first costs. Annual efforts to keep the site up to date would likely take about 2 hours per day, or approximately $40,000 per year. These costs are displayed in Table 11 below.

Table 11
Cost of Proposed Combined Water Level Data Access

Total First Cost	$ 60,000
Average Annual First Cost*	$ 5,300
Annual O & M	$ 40,000
Average Annual Cost	$ 45,300
*Based on 20-year life at an interest rate of 6-1/8%	

It may be that only certain critical water level stations would be needed and various levels of service could be implemented. Each would cost different amounts, as indicated in the NOAA and USACE sections above, and provide different data. Consultation with commercial navigation interests should be considered to determine the best options.

d) Benefits

The benefits of a combined, common data access web site would be significant to shippers who must currently combine information from different sources in order to get complete, useful data. In addition, those involved in research and other monitoring activities would benefit. The quantification of these benefits would cost significantly more than the project itself, but are deemed sufficient in light of the tonnage moved on the Great Lakes system, 221,000,000 short tons of freight in 1998 and consistently over 200,000,000 since 2000.

e) Summary

This alternative proposes to evaluate potential improvements to the water level data access within the Great Lakes system. Knowledge of past, current and forecasted water levels is an integral part of navigation on the Great Lakes, the connecting channels and the St. Lawrence River. These data are collected and disseminated by a variety of agencies in different ways. The combination of these data into a single accurate network system would improve the communication to the shippers, improve vessel loading during periods of low and high lake levels, increase safety and increase commerce, through a more reliable system. The benefits of the proposed combined system remain unquantified due to limited funding and scheduling, but are expected to exceed the costs by a wide margin. Therefore, further study is recommended.

(7). Aids to Navigation

Beacons. This alternative evaluates potential improvements to navigation aids in the Great Lakes system through replacing buoys, which are floating navigation aids, with permanent beacons. Lighted buoys are currently the primary marker system utilized in Great Lakes waterways. They must be removed in the fall prior to the onset of ice and reset in the spring after the thaw. Commercial shipping extends several weeks past the fall withdrawals and starts well before buoys can be placed in the spring. This practice increases risk to mariners and costs to shippers. The Coast Guard envisions a system in which ice resistant permanent structures replace a considerable number of buoys. Such an aid to navigation system would be more robust by providing more reliable aids and year round service. See Appendix A-Economic Analysis, *Section 8. ECONOMIC EVALUATION FINAL ALTERNATIVES* and Attachment 1 for a detailed discussion.

Table 12 presents the summary of the average annual benefits and costs for 29 Beacons. Benefits presented in the table below are all associated with reducing the labor, equipment and material costs necessary to operate a series of in-water navigation aids. While the benefits reflect the difference in the operational economics between buoys and permanent beacons, benefits associated with the reduced risk to buoy tending personnel and to mariners and vessels has not been estimated. Estimating safety benefits was beyond the scope of this reconnaissance study.

TABLE 12
SUMMARY OF BENEFITS, COST AND BCR

Average Annual Benefits	$ 622,430
Average Annual Costs	$ 759,782
Net Benefits	-$ 137,352
BCR	0.8
(-0 @ 6.125% discount w/base year 2010)	

Considering the available information, closeness of the BCR to unity, complexity of the study, and the limited schedule and funds, which prevented a thorough analysis of this alternative, therefore, it is recommended to carry this alternative forward for further analysis in feasibility.

k. Conclusions from Preliminary Screening.

The conclusions from the preliminary screening form the basis for the next iteration of the planning steps that will be conducted in the feasibility phase. The likely array of alternatives that will be considered in the next iteration includes all the above alternatives. The potential magnitude and type of benefits could include the following; (a) deepening connecting channels and ports up to 30 ft draft ($87, 000,000 annually), (b) seaway replacement locks in combination with a 35' draft channel up to Detroit and a 30'draft connecting channels and ports ($885,000,000 annually), (c) seaway replacement locks in combination with a 35' draft channel up to Lake Huron and Lake Michigan and a 30'draft connecting channels and ports ($1,417,000,000 annually), and (d) seaway replacement locks in combination with a 35' draft channel throughout the Great Lakes and St Lawrence Seaway system ($1,510,000,000 annually).

6. FEDERAL INTEREST

Since improved navigation is the primary output of the alternatives to be evaluated in the feasibility phase, there is a strong Federal interest in conducting the feasibility study. Based on the preliminary screening of alternatives, there appears to be potential project alternatives that would be consistent with Federal policies, costs, benefits and environmental impacts.

7. PRELIMINARY FINANCIAL ANALYSIS

Currently, there is no non-Federal sponsor for a feasibility study of the combined Great Lakes/ St Lawrence Seaway system. If the Canadian Government participates as the non-Federal sponsor, they will be responsible for 50 percent of the cost of the feasibility phase. In order for the Canadian Government to participate as a non-Federal sponsor, legislative action would be required. The Canadian Government is aware of the cost sharing requirements for potential project implementation. A letter of intent from the non-Federal sponsor is required stating a willingness to pursue the feasibility study and to share in its cost, and an understanding of the cost sharing for project construction.

With regards to feasibility studies for individual Ports, no non-Federal sponsor has come forward. They are awaiting a determination on whether the system wide study is to be carried forward.

8. SUMMARY OF FEASIBILITY STUDY ASSUMPTIONS

There are a certain number of assumptions that are necessary to conduct any type of planning study. They generally tend to simplify the analysis, and help the analyst focus in on the problem being studied. Several assumptions have been incorporated into the plan formulation process. The assumptions concern the existing commercial navigation system and include:

- Traffic forecasts have been developed on a system wide basis.
- Current two-way traffic patterns in the St. Marys River and the St. Marys Falls Canal would be maintained.
- Structural modifications would be designed to maintain existing water level profiles and flows.
- The costs and benefits included in the analysis are only U.S. costs and benefits.
- Base condition for navigation season

Table 13 Navigation Season				
	Season (months)	Open Date	Close Date	Closed Time
Soo Locks	9-1/4	15 March *	8 January *	66 days
Welland Canal	9	15 March	31 December	74 days
St. Lawrence Seaway	8-1/2	1 April	15 December	106 days
* Dates do not reflect actual operating practices.				

- Non-Federal actions within the authority and abilities of port authorities, state and local agencies, and the waterborne transportation industry which increase the efficiency of the existing system would be maximized. These actions include continued use of the most efficient vessels in the existing and future fleet, light loading when necessary, tug assistance when necessary, optimizing monthly mean lake levels, and utilizing alternative transportation modes and transshipment facilities when necessary.
- In analyzing commodity movements, sufficient mine reserves and/or production capacities exist throughout the period of analysis at the projected tonnage levels.
- Improvements in technology would be incorporated to the maximum extent possible in mining, grain production, transshipment and vessel operations.

- National defense. The Great Lakes system has served the nation during periods of military conflict in the past, and would be expected to do so again in the future if the need arose. To determine the existing Great Lakes/St Lawrence Seaway commercial navigation system's ability to respond to defense related demands, a sensitivity test would be needed to determine the locks' capability under various defense scenarios. Due to limited resources and time constraints, it was assumed that this analysis is not needed at the reconnaissance level but will be assessed during the feasibility phase.

9. FEASIBILITY PHASE MILESTONES

Typical Milestones for a Feasibility study			
Milestones	Description	Duration (mo)	Cumulative (mo)
1	Initiate Study/EIS	1	1
2	Public Workshop/Scope of Work	3	4
3	Alternative Formulation Briefing	6	10
4	Draft Feasibility Report/ Environmental Impact Statement	20	30
5	Public Meeting	1	31
6	Final Feasibility Report/ Environmental Impact Statement	28	59
7	DE Signs Report/EIS	1	60
8	Final Report/EIS to LRD	1	61
Note: The above schedule may vary based on the complexity of the study.			

10. FEASIBILITY PHASE COST ESTIMATE

Feasibility Phase Cost Estimate		
WBS #	Description	Cost
JA	Engineering & Cost Estimate	$ 3,500,000
JJ	Plan Formulation	$ 3,500,000
JB	Economic Analysis	$ 3,500,000
JD	Environmental Studies/Report	$ 3,500,000
JC	Real Estate	$ 450,000
JP	Management & Public Involvement	$ 3,500,000
JM	Washington Level Approval	$ 50,000
	Contingencies	$ 2,000,000
Total		$20,000,000

11. VIEWS OF OTHER RESOURCE AGENCIES

A number of Federal, State and local agencies, have expressed their views on the reconnaissance study. Comments received from a wide variety of users were placed on the web site http://www.lre.usace.army.mil/glnav/INDEX.HTM for sharing of information. Because of the voluminous amount of comments received, only a limited number of letters are shown as an attachment starting on page 49. See the above web site to view all the comments received.

12. POTENTIAL ISSUES AFFECTING INITIATION OF FEASIBLITY PHASE

Currently, there is no mechanism for the Canadian Government to participate as a non-Federal sponsor. Therefore legislative action would be required in order to proceed with a joint U.S. - Canada cost-shared feasibility study.

13. **CONCLUSIONS AND RECOMMENDATIONS**: Based on the reconnaissance analysis contained in this report it is concluded that there is Federal interest in proceeding with further studies of the Great Lakes and St. Lawrence Seaway Systems Study.

However, prior to initiation of the feasibility study, further information is needed. It is recommended that a supplement to the reconnaissance report, for clarification of the without project conditions and determination of the Federal interest, be undertaken. The purpose of this supplement is to provide needed information to support a Federal decision on whether to proceed with the feasibility study. This effort will include an assessment of baseline without-project conditions for the environment, engineering features and economic conditions, as well as public involvement and coordination. Should the recommendation be to proceed with further studies, this phase must also determine the scope of additional studies, including cost and duration, and develop a Project Management Plan. Since the system is a unique bi-national waterway, coordination with Canada that occurred during the development of the Reconnaissance Report, will continue during the reconnaissance phase as well as any future studies. Options for partnering with Canada in future study efforts are being investigated.

The following recommendations may be pursued independently:

(a) The GLSLS System Review identifies several ports on the Great Lakes where there is a federal interest in further studies. It is recommended that feasibility studies for these ports be conducted individually provided there is a non-Federal sponsor.

(b) It is recommended that a feasibility study be conducted individually for the Chicago Sanitary & Ship Canal provided there is non-Federal sponsor.

(c) It is recommended that a feasibility study be conducted individually for the St Clair River Ice Boom provided there is non-Federal sponsor.

(d) It is recommended that a feasibility study be conducted individually for Improved Water Level Data Access provided there is non-Federal sponsor.

Revised 2/3/03

(e) It is recommended that a feasibility study be conducted individually for Buoys and Beacons provided there is non-Federal sponsor.

Revised Date 2/3/03

THOMAS H. MAGNESS
LTC, EN
Commanding

Note: Original signed, 25 June 2002 by RICHARD J. POLO, JR., LTC(P)

Attachment 1 - Definition of Terms

An array of names and definitions are applied to the various waterway segments in the Great Lakes-St. Lawrence River Basin. Some waterway designations overlap others. What follows are the definitions that will be used in this study to describe the navigable waterways in the basin. These are based on most common usage in government reports and industry publications.

Great Lakes/St. Lawrence Waterway (GL/SLW) – navigable waterways from the Gulf of St. Lawrence to the Head-of-the-Lakes.

Great Lakes/St. Lawrence Seaway (GL/SLS) – navigable waterways from Montreal west to the Head-of-the-Lakes. GL/SLS includes the St. Lawrence Seaway and the Great Lakes Navigation System.

Great Lakes Navigation System (GLNS) – all five of the Great Lakes and the Great Lakes connecting channels.

Great Lakes Connecting Channels (GLCC) – navigable connecting channels between the Great Lakes: the St. Marys River, the Straits of Mackinac, the St. Clair/Detroit River system and the Welland Canal. This does not include shallow draft channels that connect with the lakes.

St. Lawrence River – navigable straight between Lake Ontario and the Gulf of St. Lawrence. It has two distinct reaches – the canalized, 26'3" draft Montreal-Lake Ontario (MLO) section of the Seaway and the minimum 35' draft reach from Montreal to the Gulf.[2] This later stretch of river is referred to in this report as the lower St. Lawrence River.

St. Lawrence Seaway – the waters of the St. Lawrence River above Montreal, Lake Ontario, the Welland Canal, and Lake Erie as far west as Long Point. It includes the Welland Canal and the Montreal-Lake Ontario section. Data displays in this appendix conform to SLSMC and SLSDC Seaway statistical presentations, which do not include intra-Lake Ontario waterway traffic.

Welland Canal Section – eight lock canal linking lakes Erie and Ontario. This section of the St. Lawrence Seaway is the only all Canadian Great Lakes connecting channel.

Montreal-Lake Ontario (MLO) Section – seven-lock canalized section of the St. Lawrence Seaway lying entirely within the St. Lawrence River and extending from the St. Lambert Lock to Lake Ontario beyond the Iroquois Lock.

[2] The 26'3" draft presently allowed in the Seaway is not available all of the time because of variable water levels.

Attachment 2 - Agency Letters

Lake Carriers' Association

GEORGE J. RYAN
PRESIDENT
Direct Dial: 216-861-0590
E-Mail: ryan@lcaships.com
Website: www.lcaships.com

February 21, 2001

Mr. Scott Parker
Chief – Programs & Project Management Division
U.S. Army Corps of Engineers
477 Michigan Avenue
Detroit, MI 48226

Dear Scott:

The Great Lakes Navigation System Study is of great importance to our industry. This study will set the course for infrastructure improvements needed by the Great Lakes region over the next 50 years.

The attached statement is Lake Carriers' Association's vision for the Great Lakes transportation system. Please include these thoughts in your preparation of the Study outline.

We look forward to working with the U.S. Army Corps of Engineers and other agencies as you continue this long-term effort.

Sincerely,

George J. Ryan
President

GJR:cal
Attachment
ryan\coe\navigation-study\010221-1-parker

cc w/att.: Daniel E. Steiner – U.S. Army Corps of Engineers-Great Lakes & Ohio River Division
Members – LCA Advisory Committee
Members – LCA Navigation Committee
Steve Fisher – American Great Lakes Ports
Donald N. Morrison – Canadian Shipowners Association
Raymond Johnston – Chamber of Maritime Commerce
Davis Helberg – Duluth Seaway Port Authority

Lake Carriers' Association

Prepared for U.S. Army Corps of Engineers
As Preliminary Advice in Preparing the Plan for the Great Lakes Navigation Study
February 21, 2001

VISION FOR THE GREAT LAKES TRANSPORTATION SYSTEM

SUMMARY

1. **Increase Project Depth of Connecting Channels and Major Ports to a minimum of 30 feet.**
2. **Maintenance Dredging must take into consideration the expected reduction of water levels below datum.**
3. **Improvement of the major channels in the St. Marys River to permit two-way traffic for deep draft vessels in the West Neebish Channel or, if that is not feasible, dredge Middle Neebish Channel to a uniform width to allow deep-draft vessels to transit at system-wide project depth.**
4. **Port and Channel Infrastructure Needs Analysis to be completed to determine what size channels, depths, turning basins, and anchorages are needed based on current and projected traffic.**
5. **Confined Disposal Facility (CDF) Maintenance and Construction to be established to meet the needs of the new system dimensions.**
6. **Replacement Lock at Sault Ste. Marie, Michigan, to be appropriated at soon as possible.**
7. **Great Lakes System of Water Level Gauge Information Communication to be created to provide real-time water level data to Captains.**
8. **Navigation Systems onboard ships using electronic charts, satellite navigation and communication, and an Automated Information System (AIS).**
9. **Restore Full Federal Funding for Operation and Maintenance Dredging (O&M).**
10. **Length of navigation season must be re-evaluated to determine if current lock opening period from March 25 – January 15 can be lengthened given possible changed environmental conditions.**

BACKGROUND

Every interest group has a unique vision for the Great Lakes. Those groups/interests include agricultural, recreational, electric power generators, transportation, and many others. Within the transportation sector, there will be different visions held by the domestic and interlake trade carriers and those involved in deep-sea trade through the St. Lawrence Seaway. The goals of each are at times in harmony and at times in conflict.

Transportation interests' vision is rooted in the need to meet the legitimate demands of the industries they serve. In the Great Lakes region, the primary industries are steel, construction, power generation, and agriculture. American and Canadian industries are faced with stiff international competition and must continue to reduce costs through capital investment in new technology and economies of scale. Both of these factors are evident in the operation of vessels in the U.S.-Flag domestic trade. Super-sized newer vessels and modernized older vessels can carry 125 million tons of raw materials annually to fuel the Great Lakes region's economy. Unfortunately, the infrastructure of the Great Lakes transportation system is based upon size constraints of the 1930s for the St. Lawrence Seaway and the 1950s for the Great Lakes ports and connecting channels.

1. **Increase Project Depth of Connecting Channels and Major Ports**
The dimensions of the primary infrastructure, the locks, connecting channels, and major ports, are major constraints on the Great Lakes water transportation system and the ability of carriers to meet the needs of the industries served in the 21st Century. The size of many ports and some channels limit the use of the more efficient 1,000-foot long vessels. The width of the upbound channel in the St. Marys River limits the use of the super-sized vessels in a full-load condition. However, the primary limiting dimension in the system is the depth of water in a channel or lock. The project depth, authorized in the 1950s for the Great Lakes system, is 25.5 feet at mean low water datum (also known as chart datum). Often, the Lakes water levels are several feet above chart datum and, thus, loading to as much as 28.5 feet has taken place in the domestic trade of iron ore and coal through the St. Marys River. This fact proves that industry can effectively utilize existing vessels at the deeper draft and that the shippers, primarily steel mills and coal-fired utilities, benefit from larger loads. Nevertheless, there are times when the water level falls below datum and drafts are severely limited to authorized project depth or less. We are faced with these low waters now and for the foreseeable future.

   The Great Lakes system needs to have a reliable, greater depth suitable to meet the needs of the 21st Century where worldwide competition demands more cost effective transportation. The target depth should be a Great Lakes system capable of handling ships with a draft of 30 feet or greater at all times in all connecting channels and major ports — regardless of water level fluctuations. The major constraint factor to be considered should be the safe transit over the sill of the Poe Lock and the new lock to be constructed.

2. **Maintenance Dredging**
While no one can accurately predict future water levels, given a worldwide warming trend, certain changes in water levels are expected to occur. On the oceans, as the polar ice melts, there will be higher water levels impacting coastlines. In the Great Lakes, with lower winter snow loads, less ice cover, and warmer air, there will be higher evaporation rates and reduced supply of water from spring thaws. The result will be lower water levels. Because of the precipitous, large drop in the water levels, the U.S. Army Corps of Engineers is unable to adequately maintain the commercial and recreational harbors in the Great Lakes to the Congressionally authorized depths.

   Every inch of lost draft reduces the efficiency of waterborne commerce. The largest vessels, the 1,000-foot-long supercarriers, forfeit 270 tons of cargo for each 1-inch reduction in loaded draft. An ocean-going vessel in the Seaway trade loses 100 tons of cargo for each 1-inch reduction in loaded draft.

   Congress should pass sufficient appropriations so as the Corps can carry out the authorized dredging of commercial harbors, taking into consideration the expected water levels below datum.

3. **Improvement of the Major Channels in the St. Marys River**
From 1870 through 1956, Congress authorized the various channels and locks in the St. Marys River. For a number of reasons, there are two one-way channels around Neebish Island. The east side, known as Middle Neebish Channel, is the upbound channel; although, with tight traffic control, good seamanship and reduced draft requirements, it can be navigated by a downbound vessel in a one-way traffic scheme. The west side, known as the West Neebish Channel, is the deep-draft downbound channel. Neither channel is wide enough for two-way traffic. **Our vision is to have a two-way traffic channel in the West Neebish Channel.** This would require a major dredging project from Nine Mile Point in Lake Nicolet to the Lake Munuscong Junction Buoy. The cost of annually maintaining the channels by the Corps of Engineers and the U.S. Coast Guard on both sides of Neebish Island could be significantly reduced if there was one two-way channel. For example, there are over 60 floating aids to navigation and a number of fixed aids in the 17 plus statute miles of Middle Neebish Channel — these could be eliminated. **Alternatively, if the benefit/cost analysis is not favorable, then the Middle Neebish Channel could be designed to be a safe downbound channel by removal of the 21-foot channel on the east side of courses 5 through 9. The entire channel should be dredged to the newly authorized system depth.**

4. **Port and Channel Infrastructure Needs Analysis**
A comprehensive analysis of the existing and expected trade through each Great Lakes port must be made to determine if the channel design and turning basins are sized correctly for the commerce expected over the next decades. There may be many ports that could benefit from wider and deeper channels while there are several ports that have lost the potential for significant growth and, therefore, may not need the maintenance of two-way traffic channels or channels with the currently authorized width and depth.

5. **Confined Disposal Facilities (CDF) Maintenance and Construction.**
In the 1970's, the Federal Government built 26 CDFs in the Great Lakes to hold dredged sediments from Great Lakes ports and waterways. Some of these sediments contained polluted material. The capacities of these CDFs are not infinite, so plans must be made to create new CDFs in order to receive the polluted material from normal maintenance dredging and from the clean up of the hot spots in areas of special concern where remedial action plans are in effect. **More CDFs must be authorized and built to handle the recommended project depth. Studies must be made to determine which of this dredged material can be used for land creation or open lake disposal.**

6. **Replacement Lock at Sault Ste. Marie, Michigan**
Complete plans and specifications for the new lock at Sault Ste. Marie, Michigan, capable of handling the Poe-class vessels that now represent approximately 70 percent of U.S.-Flag carrying capacity on the Great Lakes. Provide Federal share of appropriations for construction when the Great Lakes Commission has finalized the sponsorship agreement with the Governors of the Great Lakes States. **Consider construction appropriations for FY02.**

7. **Great Lakes System of Water Level Gauge Information Communication**
The Great Lakes water levels are in a dynamic state. While these waters are not as seriously impacted by tides as on ocean coasts, there are significant fluctuations caused by annual cyclical changes of water supply, unpredictable changes caused by wind and barometric action, and longer-term changes caused by drought or wet periods. For the safety and productivity of shipping in the domestic trade where turnaround times between load and discharge ports range between a matter of hours to three days, the knowledge of water levels in the area to be navigated is a great asset to the Captain of the ship. There is no system-wide manner to obtain this data in useable format and communicate it to the Captain on the ship in real-time. **U.S. and Canadian Government agencies responsible for water level measurements must put together a real-time water level communications system.**

8. **Navigation Systems Onboard Ships Using Electronic Charts, Satellite Navigation and Communication, and an Automated Information System (AIS)**
While not the direct responsibility of the U.S. Army Corps of Engineers, the Corps and the U.S. Coast Guard must take into consideration in channel design and aids to navigation installation the changed technology that will be onboard all vessels by the time the new infrastructure is in place. When the Corps carries out channel surveys in the future, the results of those surveys can be conveyed to the electronic chart suppliers and to the Captains through the AIS. The dimensions of the channels can be designed with tolerances that not only take into consideration the weather, wind, current, and other local and environmental conditions, but also the expectation of more accurate navigation.

9. **Restore Full Federal Funding for Operation and Maintenance Dredging (O&M)**
From the founding of our nation until 1987, the Federal Government funded O&M dredging of the nation's waterways from general revenues. A Harbor Maintenance Tax (HMT) was instituted in 1987 to recover 40 percent of O&M costs in the deep-draft waterways (the HMT has never been assessed on the inland waterways). When the HMT was tripled in 1991 to recoup over 100 percent of deep-draft O&M, legal challenges began that eventually led to the Supreme Court voiding the tax on exports. Legal challenges continue and, as a result, the past Administration proposed a substitute Harbor Services User Fee (HSUF) that would expand collections to include the Federal Government's share of new construction projects. In total, the HSUF would have added $1 billion a year to the nation's freight bill. The current Harbor Maintenance Trust Fund contains a surplus of $1.668 billion because of excess collections over expenditures. Even with revenues reduced by the exclusion of taxes from exports, and with revenues now coming primarily from imports, the fund continues to build a surplus. The role of waterborne commerce in our nation's economic well-being and national security demands a return to full Federal funding. Domestic waterborne commerce routinely tops 1 billion tons a year. Ninety-eight percent of our imports and exports move across the oceans in vessels. There is hardly a job or industry in this country that is not dependent on an efficient system of ports and waterways. Furthermore, a recent GAO study has determined that 11 Federal agencies already assess 124 taxes on waterborne commerce that annually generate more than $21 billion for the Federal treasury. **Maintenance of our channels can be funded through a cash transfer of revenue raised through import duties, just as the Department of Agriculture funds its marketing programs.**

10 Length of Navigation Season Must Be Re-Evaluated
To Determine if Current Lock Opening Period From March 25-January 15
Can Be Lengthened Given Possible Changed Environmental Conditions

The agreement between the State of Michigan and various Federal agencies regarding the period of opening of the Locks at Sault Ste. Marie was based, in part, upon concern for environmental conditions related to ice cover and the break-up of the ice on the fisheries and the shoreline. A recent assessment completed by the Environmental Protection Agency, *Preparing for a Changing Climate, Great Lakes Overview, October 2000*, indicates that we may be in a warming trend that will result in higher average temperatures throughout the region, lower water levels, and reduced ice cover. Since this study must review all technological data impacting on the navigation system, these environmental changes must be carefully reviewed. Should there be a period of low water, tonnage will have to be shipped either over a longer period of time using the existing fleet or there will be a need to invest capital in the construction of new vessels. While ship construction may appear to be good for the economy, in the long run, it will add costs to the steel industry that is fighting for its survival against subsidized foreign imports. A preferred option is to optimize existing vessels. The study should determine the circumstances under which a longer period of lock opening could take place. It is essential to maintain fixed open and close dates so as supply decisions can be made with certainty. While the fixed closing date could be extended, it may also be possible to allow for continued vessel operations until some later date following the fixed closing date based on environmental conditions at Sault Ste. Marie. The season extension primarily should be at the end of the season when navigation can more readily continue while ice is forming, rather than at the opening of the season when heavy ice conditions may exist.

ryan/coe/lca vision/010221

Minnesota Pollution Control Agency

February 9, 2001

Mr. Terry Long
Attn: CELRE-PM-PL
Department of the Army
Detroit District, Corps of Engineers
Box 1027
Detroit, MI 48231-1027

RE: MPCA Comments Regarding the Proposed Study to Review the Great Lakes Navigation System

Dear Mr. Long:

The Minnesota Pollution Control Agency (MPCA) staff appreciate the opportunity to provide comments on the scoping of work regarding the proposal to study the Great Lakes Navigation System. The MPCA is authorized under Section 401 of the Clean Water Act (33 USC 1251 et seq.) and Minnesota Statutes Chapters 115 and 116 to evaluate projects that have the potential to impact waters of the state.

While some of the following issues identified by MPCA staff are not a direct responsibility of the Corps, these topics do and will play some type of role in the decisions of the Corps and in Great Lakes shipping:

- Areas of Concern - Most of the designated harbors in the Great Lakes also have significant environmental impairments and have been designated Areas of Concern. This issue should be a factor in any future studies and decisions of the Corps of Engineers in the Great Lakes region.

- Dredging - If dredging is a potential outcome of this study, the Corps of Engineers should also consider the direct and indirect impacts of dredging, including management of dredged material (reuse and disposal options and restrictions).

- Source Reduction of Sediments - More focus should be placed on source reduction (i.e., keeping the soil on the land) as a means to reduce the volume and frequency of dredging needed to maintain shipping channels.

- De-Authorization of Federal Channels - If a potential outcome of this study requires Congressional action, the Corps should consider requesting de-authorization of those federal navigation channels that have not been actively maintained. For the Duluth-Superior harbor, this would include the Minnesota Channel Western Section and 21st Avenue West Channel.

- Spill Containment/Prevention at Docks and Refueling Stations - Any increase and/or expansion of shipping operations should also consider prevention and minimization of environmental impacts from fueling.

  Ship Wastewater Treatment Facilities - The current on-vessel wastewater systems are largely outdated, inadequate and unmonitored. In addition to improving the currently used technology, an option worth further consideration is to improve the systems or replace with holding tanks and utilize ship-to-shore wastewater disposal.

- Expansion of the "no discharge zone" in Lake Superior - The discharge of bilge and greywater from vessels goes largely unregulated. The study should consider expansion of the "no discharge zone" bilge and greywater to include the whole of Lake Superior.

- Exotic Species - One method of introduction and spread of exotic species in the Great Lakes has been through shipping activities. The study should consider exotic species, including their movement, impacts, and legal approaches and technologies to contend with the problem.

- Viability of Expanding the Shipping Infrastructure on the Great Lakes - There have been discussions regarding expanding the locks in order to accommodate larger vessels, in part to compete with coastal harbors. Careful consideration should be given to these types of proposals to determine if the benefit outweighs the cost and if there are other alternatives, such as shipment by rail.

- Water Diversions - There have been past proposals to divert water from the Great Lakes for use in other areas of the U.S. and Canada. The study should consider the status of such proposals and the potential impacts that this activity would have on commerce and the environment of the Great Lakes.

  Global Warming - Global warming may result in drastic changes to the environment. How will global warming impact commerce and the environment of the Great Lakes?

- Environmental Impact of Outcomes of the Study - All environmental impacts of projects should be considered during and be a part of the decision-making process. For example, if one outcome is to widen and/or deepen federal navigation channels, then consideration should be given to the disposal/reuse management of the dredged material. This would include the likelihood that dredging beyond current channel dimensions may result in re-introduction of contaminated sediments and pose a disposal issue for those sediments.

Thank you again for the opportunity to provide input on this effort. If you have any questions regarding this letter, please contact me at (218) 723-4744.

Sincerely,

Patrick Carey
Supervisor, Community & Area-Wide Programs Unit
North District, Duluth Office

PC:kt

New York State Department of Environmental Conservation
Division of Environmental Permits, Region 6
Dulles State Office Building, 317 Washington Street, Watertown, New York 13601-3787
Phone: (315) 785-2245 • **FAX:** (315) 785-2242
Website: www.dec.state.ny.us

John P. Cahill
Commissioner

February 7, 2001

Detroit District - Corps of Engineers
ATTN: CELRE-PM-PL Mr. Terry Long
P.O. Box 1027
Detroit, Michigan 48231-1027

RE: Great Lakes Navigation System (GLNS)

Dear Mr. Long:

This office of the Department of Environmental Conservation would like to take this opportunity to comment on the new study, the Great Lakes Navigation System (GLNS) Review. The jurisdictional boundaries of this office include Eastern Lake Ontario and the St. Lawrence River, and therefore, factors that impact upon these waterways are of obvious concern to this office as well as to the general public.

Issues that are of significant concern include the following:

1. The water level management of Lake Ontario and the St. Lawrence River has severely impacted and will continue to cause problems to the wetland systems located along these waterways and to the numerous small islands and shoal areas that are scattered throughout the system.

2. Dredging of any navigation channels that would include straightening, widening or deepening of existing channels or the creation of new channels.

3. Any navigation that occurs when an ice cover has formed on the St. Lawrence River and the increased environmental damage and damage to shoreline structures.

4. The potential environmental impacts associated with increased shipping, particularly on the St. Lawrence River section, including the higher potential for spills, increased impacts from ship wakes, and the potential for greater conflict between recreational versus commerical users.

5. The introduction and spread of contaminants throughout the system.

6. The water quality of the Great Lakes-St. Lawrence system and the potential of degradation of the water quality for recreational, industrial and consumptive usage.

During this entire planning and study process this office has a significant concern to stay in the information loop and requests that copies of any research proposals, summary or final reports, or recommendations generated during the GLNS Review process be forwarded to this office. From our perspective, it would be helpful to be informed early in the process to allow for a thorough review of items by appropriate staff.

Thank you for providing this office the opportunity to comment on the GLNS Review and to become involved in the process.

Sincerely,

Lawrence D. Gunn

Lawrence D. Gunn
Environmental Analyst 1
Region 6

LDG:dli

cc: Sandy LeBarron, Regional Director, Region 6 DEC
Albert Schiavone, DEC
Dennis Faulknham, DEC
Leonard Ollivett, DEC
Brian Fenlon, DEC

STATE OF MICHIGAN

JOHN ENGLER, Governor

DEPARTMENT OF ENVIRONMENTAL QUALITY

"Better Service for a Better Environment"

HOLLISTER BUILDING, PO BOX 30473, LANSING MI 48909-7973

INTERNET: www.deq.state.mi.us

RUSSELL J. HARDING, Director

February 5, 2001

Detroit District, Corps of Engineers
P.O. Box 1027
Detroit, MI 48231-1027

Attention: CELRE-PM-PL/Mr. Terry Long

Dear Mr. Long:

SUBJECT: Great Lakes Navigation System (GLNS) Review

This letter responds to the January 18, 2001, communication from Wayne Schloop, Project Manager, Planning, Programs and Project Management, soliciting comment on the scope of the Great Lakes Navigation System (GLNS) Review authorized by Congress.

In light of Mr. Schloop's statement that "the ultimate aim of the study is to produce an efficient and modern environmentally sound navigation system on the Great Lakes," we strongly recommend that the prevention of further introduction of aquatic nuisance species into, or the export of same out of, the Great Lakes–St. Lawrence Basin be made a part of the GLNS.

The Great Lakes are infested by roughly 160 aquatic nuisance species such as the sea lamprey, zebra mussel, Eurasian ruffe and the spiny water flea at a cost of, literally, billions of dollars. These exotic species threaten a $4 billion sport fishery in the region. Unfortunately, the latest research forecasts the introduction of another 17 such aliens from the Ponto-Caspian Basin alone.

Several topics for possible review are:

1 barriers - physical, mechanical or electrical - preventing entry or exit of aquatic nuisance species at both ends of the system, including the Chicago Diversion;

2. facilities for shoreside sterilization of ballast water and NOBOB vessels generally;

3. the needs of the U.S. Coast Guard in enforcing current and future laws and regulations; and

4. any other ideas from other interested parties such as the U.S. Fish and Wildlife Service, the Great Lakes Aquatic Nuisance Species Panel, and the Great Lakes Fishery commission.

Thank you for your interest.

Sincerely,

G. Tracy Mehan, III
Director
Office of the Great Lakes
517-335-4056 / fax: 517-335-4053
e-mail: mehang@state.mi.us

cc: Mr. Russell J. Harding, Director, MDEQ

INDIANA PORT COMMISSION I.S.T.A. CENTER • 150 WEST MARKET STREET • STE. 603 • INDIANAPOLIS, INDIANA 46204 • USA • (317) 232-9200 • FAX: (317) 232-0137

Clark Maritime Centre
5100 Port Road
Jeffersonville, Indiana 47130
FTZ #170
(812) 283-9662

Indiana's International Port /Burns Harbor at Portage
6625 S. Boundary Drive
Portage, Indiana 46368
FTZ #152
(219) 787-8636

Southwind Maritime Centre
1700 Bluff Road
Mount Vernon, Indiana 47620
FTZ #177
(812) 838-4382

January 30, 2001

Mr. Wayne Schoop
Programs & Project Management Division
USACE – Detroit District
PO Box 1027
Detroit, MI 48231-1027

Re: Great Lakes Navigation Study

Dear Mr. Schoop:

The Indiana Port Commission, along with several port authorities in the Great Lakes states, has the unique ability to transport waterborne commerce through both the Great Lakes Navigation System and the Inland Waterway System. These unparalleled navigation systems in the heart of the North American Continent provide a vital logistics link for shippers of domestic and international cargo. Indiana's farmers and manufacturers enjoy substantial cost savings because of the existence of these waterways, as well as the societal environmental benefits derived from the movement of bulk tonnage by water rather than by road or rail.

Indiana's International Port moves substantial bulk tonnage through its Burns Harbor, Indiana facility on Lake Michigan. In recent years the port has moved increasing amounts of general cargo, primarily steel products. In both the bulk and general cargo trade, the vessel departs the port at Seaway Mean Summer Draft (26' 3") rather than at full-vessel draft. The vessels are generally topped off once they are in deeper water east of Montreal. This situation costs both the shippers and consignees valuable time and money through delays and multiple vessel stops. Increasing the channel draft in the Great Lakes Navigation System from 26' 3" to between 30' and 35' would add substantial cost incentives for shippers utilizing our port.

Vessel safety has become an increasing concern, especially with the low water levels of the Great Lakes during the past several navigation seasons. Indiana's International Port experienced three groundings during the 1999 / 2000 shipping season. Due to vessel safety concerns the Commission performed emergency dredging within the harbor in the spring of 2000. The primary delay involved with the emergency dredging project was due to the difficulty of securing U.S. Army Corps of Engineers permits. If feasible, the Navigation Study should review the permitting process necessary for accomplishing emergency dredging.

During the past two decades, the size of almost all ocean-going vessels has increased significantly. Vessels transiting the Great Lakes/St. Lawrence Seaway, however, have been restricted because of unchanging lock dimensions. The Great Lakes Navigation Study needs to evaluate the locks of the St. Lawrence Seaway and identify what System changes would be most beneficial to shippers and the Great Lakes maritime community while maintaining a reasonable cost for lock rehabilitation or replacement.

The Indiana Port Commission considers the Great Lakes Navigation Study a timely and most important Corps of Engineers project. We stand ready to assist in any way possible with your effort.

Regards,

William D. Friedman
Executive Director

DETROIT/WAYNE COUNTY PORT AUTHORITY
MICHIGAN'S INTERMODAL GATEWAY

November 29, 2000

Mr. Daniel E. Steiner
Chief, Planning and Policy Division
U.S. Army Corps of Engineers
Great Lakes & Ohio River Division
John Weld Peck Federal Office Building
550 Main Street, Room 10-008
Cincinnati, Ohio 45202

Dear Mr. Steiner:

On behalf of the American Great Lakes Ports, I would like to express our sincere interest and extend our assistance in developing justification and direction for the Great Lakes Navigation Study authorized through the Water Resource Development Act (WRDA) for 1999. This comprehensive planning initiative is vitally important for both American and Canadian Great Lakes ports in order to ensure the competitiveness of our region within the global marketplace.

This initial reconnaissance study would help determine the needs and opportunities for growth within the Great Lakes/Saint Lawrence Seaway System by prioritizing critical areas of concern. The many stakeholders utilizing this system are depending on this study to identify the strengths of our current system, as well as the problems, weaknesses and threats. It is important to include a broad definition of economic benefits to be realized from navigational improvements in the benefit cost analysis of this study.

The Great Lakes/Saint Lawrence Seaway System is home to almost one-half of both the American and Canadian population. The region has the five largest steel producing states in the country, accounting for approximately 70% of total U.S. production. Further, almost one-half of the Fortune 500 Industrial Companies are headquartered here.

Since 1959, the Saint Lawrence Seaway has provided a global link between the world marketplace and the industrial and agricultural heartland of North America. The 2,000-mile long seaway system is responsible for annual commerce exceeding 200 million net tons. Responsible for carrying this cargo are 75 U.S. lakers, 90 Canadian lakers, nearly 1,000 saltwater vessels, and about 50,000 barges connected to the rivers that feed this system. Fanning outward from this major international artery are 40 provincial and interstate highways, nearly 30 rail lines which in turn link 15 major ports and 50 regional ports with consumers, products and industries all over North America.

8109 E. JEFFERSON AVE., DETROIT, MICHIGAN 48214
TEL: 313•331•3842 FAX: 313•331•5457

Agricultural products, primarily grain for export, comprise nearly 40% of the Great Lakes/Saint Lawrence Seaway trade. Another 40% of this trade consists of mining products including iron ore, coal, coke, salt and stone. Iron and steel products equate to the highest value goods traded due to their labor-intensive handling requirements. It has been estimated that for every imported metric ton of steel, $250 in economic impact is created for the community in the form of personal income, taxes and related business revenue. In total, it has been estimated that over 45,000 U.S. jobs and more then $2 billion in personal income are directly generated by the shipping of commodities and manufactured products on the Great Lakes.

The environmental efficiency of Great Lakes shipping cannot be matched. A 1993 study by the Great Lakes Commission of eleven trade routes on the Great Lakes showed that by utilizing ships, we save 14 million gallons of fuel and reduce emissions by more than 4,300 tons. It is a fact that a single 1,000-foot ship carries the equivalent of six 100-car unit trains. Efficiency like this requires attention, consistent study and federal involvement and appropriation. Without such attention, we will be cheating ourselves of one of our richest and most ecologically sensitive resources. Railroads would have to more then double their fuel efficiency to equal that of the Seaway System.

The study went on to report that a vessel-to-rail shift for the eleven cargo flows would statistically result in thirty-six more rail crossing accidents, fourteen more derailments and one train collision. The commodities that trucks might carry statistically would produce 141 more truck/car accidents on the roads and highways, one quarter of which would have the potential for fatalities or serious injuries.

Furthermore, with the passenger cruise industry emerging once again on the Great Lakes, the safety of the system becomes an even greater priority. It is estimated that in 2001, Great Lakes ports can expect to service over 6,000 passengers and an estimated 10,000 by 2002. Because this industry is continuing to grow, it is vitally important that our federal government take preventative steps early in reducing the possibilities of accidents and navigational problems that might threaten the safety of passengers. Such precautions will reduce liability, as well as increased costs that might be associated with future emergency navigation improvements.

Despite the substantiating environmental and economic factors, most of the seaway infrastructure dates back to design principles of the 1930's. Harbors, locks, channels and turning basins were designed with ships from this era in mind. What was a unique and incredibly modern transportation system then, has turned into an aged and outdated system that doesn't cater to a developing and mobile fleet of ships. A 1996 study by the Saint Lawrence Seaway Development Corporation found that only 40 percent of the world fleet could transit the Seaway locks. This percentage has diminished over time, falling to a mere 30 percent of the world fleet according to some recent estimates. In addition, even if a 105-

foot by 1000-foot vessel could transit the locks, it wouldn't necessarily fit into channels and harbors of many regional ports, reducing the efficiency of the Great Lakes/Saint Lawrence Seaway system.

The shipping industry we are all trying to serve and provide appropriate infrastructure for is a "mobile" industry. Vessels are not required to operate on the Great Lakes/St. Lawrence Seaway system. If it becomes cheaper and more efficient to carry cargo and serve the deep-water ports of the East Coast, then they will do this. If it becomes easier to navigate and serve ports that can feed the Midwestern ports by rail, they will do this as well.

The Great Lakes Navigation Study provides a useful tool for responsible planning to address the system's shortcomings. Issues concerning upgrade and maintenance of the Great Lakes / Saint Lawrence Seaway system are of vital importance if we are going to ensure the viability and strength the Midwest provides our nation. This study is needed to bring the St. Lawrence Seaway System up to the same competitive level that our other U.S. and Canadian transportation systems enjoy. Our organization would like to make a variety of recommendations as you prepare to begin work.

First, the American Great Lakes Ports Association asks that a primary focus of the Great Lakes Navigation Study be the maintenance and modernization of the St. Lawrence Seaway itself and related improvement to connecting channels and ports throughout the system. The feasibility, costs and benefits of an expansion of the Seaway locks - in width, depth and length - to accommodate larger vessels should be analyzed. Specifically, we are asking for expansion and/or replacement of the existing 15 Seaway locks.

Second, we support the proposal of the Lake Carriers' Association to examine the feasibility of deepening connecting channels and ports to a depth of at least 29.5 feet. Although the width of channels and locks presents problems of its own, the primary limiting dimension in the system is the depth of water in a channel or lock. Industry has proven in times of higher water levels (above low water datum) that they can effectively use their vessels at deeper drafts and that shippers benefit from these larger loads. As water levels have returned to historic levels, shippers are forced to load their vessels much lighter, erasing economies of scale and creating safety concerns where shallows spots emerge throughout the system. Maintaining adequate channel and harbor drafts become more crucial when you consider for every one-inch of reduction in depth, a 1,000 foot freighter forfeits approximately 270 tons of cargo. This loss of cargo must be made up with more trips, which creates greater fuel consumption and increased cost incurred by both the shipper and customer, thus becoming inefficient for everyone.

Third, sediment build-up on channel and river bottoms adds new problems, many of which could be reduced with proper planning and erosion control techniques. A study of the Cuyahoga River in Cleveland found that 54 percent of sediment build-up was from upland erosion. Lake Erie and the Detroit River Livingston Channel also demonstrate the need to increase channel depth. To identify where this is occurring, more research and studies need to be completed that include funding options through various engineering techniques. By controlling this problem early, we can avoid high-cost maintenance in the future.

Finally, we strongly urge the Corps of Engineers to invite the Government of Canada and the Canadian maritime industry to fully participate in the Great Lakes Navigation Study as an equal partner. The Great Lakes / St. Lawrence Seaway System is a binational waterway. Much of the infrastructure is in Canadian territory. If this study is to be of future use, it cannot be seen as an "American study." Canadian participation and buy-in will help to ensure that both governments respond to the study's recommendations. We are happy to work with the Corps to facilitate communication with Canadian stakeholders and policymakers.

Over 30 million people rely on the Great Lakes/St. Lawrence Seaway system, either recreationally or commercially. The vital importance of this system should directly correlate to the amount of federal involvement and funding set aside to ensure its viability and strength as we enter this new century. Channel and harbor deepening projects and lock dimension improvements top the list of priorities for commercial shipping interests. The time is now for all stakeholders dependent on this vital transportation system to plan ahead for much needed improvements, or we will be faced with monumental infrastructure problems down the road that cannot meet tomorrow's challenges.

Sincerely,

John Jamian
Chairman
American Great Lakes Ports

U.S. Department of Transportation
Maritime Administration
Great Lakes Region

August 25, 2000

Daniel E. Steiner, P.E.
Chief, Planning Division and Navigation Account Manager
U.S. Army Corps of Engineers
Great Lakes and Ohio River Division
P. O. Box 1159
Cincinnati, Ohio 45201-1159

Dear Mr. Steiner,

As way of introduction, Craig Middlebrook, Deputy Administrator, St. Lawrence Seaway Development Corporation, phoned recently to tell me about the Corps sponsored Great Lakes Navigation System Review project. This is a very timely project since the Department of Transportation has been holding Maritime Transportation System (MTS) review meetings around the country. During the early phases of MTS, the U.S. Coast Guard Ninth District initiated the Great Lakes Waterway Management Forum as the regional version of National MTS. This "Forum" membership is made up of U.S. and Canadian government and marine industry representatives with sole purpose of improving the Great Lakes waterways for all users - recreational as well as commercial. I am sure that the "Forum" members would like to help you with your new project.

The Maritime Administration (MARAD), Great Lakes Region staff – all three of us – are willing and able to provide technical assistance to you during your study project. MARAD's role is to promote waterborne commerce – U.S. shipbuilding – and U.S. maritime employee training – in domestic and international trade. The enclosed MARAD Annual Report describes our ship financing programs, national defense, and promotional activities. Our region responsibility includes monitoring and assisting the maritime industry in the Great Lakes as well as on the Ohio, Missouri, Upper Mississippi River and Illinois Waterway. A number of Great Lakes vessel operators are our customers through the Title XI Ship Financing and Capital Asset Fund Programs.

Recent DOT Listening and Dialogue Sessions with other Federal agencies and the maritime industry seem to run on a strong theme for the urgent need to improve the infrastructure of the American waterways. The general perception of the maritime industry is that the Nation is loosing ground in the maintenance and support for waterway improvements. This includes, specifically, dredging harbors and disposing of sediment, and the updating of connecting channels and locks to meet the needs of today's vessels as well as the potential benefit for larger vessels in the future.

The vessel efficiency issue is difficult to fully understand by those that are not directly involved in day to day operations. But, briefly, all vessels are designed to carry as much revenue producing cargo as possible and operate 24 hours a day – 7 days a week – and every day that the waterway is open. In some cases, there are vessels operating year-round within certain portions of the Great Lakes and Inland Waterways. In other cases, large vessels operate during shorter seasons due to their trade patterns in the Upper Lakes or through the Seaway. In every case, these vessels rely on the most efficient use of the waterways full dimensions – length – beam and depth. Some operators fine-tune their vessel loading to daily weather conditions and water level reports at loading and discharge ports. If winds are blowing water into a distant discharge port – they may load on a few more revenue producing tons. Other operators, such as those operating in the Seaway, are somewhat restricted by a longer-range draft forecast and limits set by the U.S. and Canadian Seaway authorities. The most efficient vessel operation is finely tuned to the maximum use of the waterways. Anything less – is unacceptable.

The general perception from the maritime representatives at DOT meetings is – the U.S. is failing to keep up with the waterway demand. According to the An Assessment of the U.S. Marine Transportation System – a Report to Congress – September 1999 - global maritime trade is predicted to grow 3.5 percent annually

2860 South River Road • Suite 185 • Des Plaines, IL 60018-2413
(847) 298-4535 • Fax: (847) 298-4537 • E-mail: maradgl@aol.com

through year 2020. Vessel operators are expressing concern about existing water capability – let alone any increasing demand on existing waterway infrastructure.

This issue is even more important in the existing trade throughout the Great Lakes region. Many Great Lakes harbors have project depths of less than connecting channels or lock depth. This historical design criteria restrains efficient vessel operation and commercial development. We recommend studying those commercial harbors that have project depths of less than Seaway or SOO Lock depth to determine their present commercial needs. Perhaps a limited number of ports can be selected for a case study. Two ports that come to mind are Green Bay, WI and Waukegan, IL. Both ports have impressive growth potential if they only had deeper harbors. According to the SLSDC, their goal is to achieve a 27 foot draft in the in the next few years. In addition, the Lake Carriers Association recently expressed interest in achieving a 29.5 foot draft throughout the Upper Lakes. Certainly, there is maritime industry support for improved waterways.

We recommend that you consider a review of the world and regional vessel fleet dimensions as it relates to the projection for future harbor and lock design. The recent increased allowable vessel size through the Seaway has created new vessel construction and reconstruction of existing vessels. Canadian vessel owners have converted several Seaway vessels to fit the modern dimensions of 740' LOA 78' Beam and 26' 3" draft. These "wider" vessels can carry substantially more due to their new "cubic" capacity. In addition, recent new vessel buildings by ocean vessel owners have increased carrying capacity by building shorter but wider ocean vessels capable of transiting the 78' locks. This improvement in vessel efficiency and shipyard activity was accomplished by a review of the existing locks and without any new construction cost. The review of proposed Second Lock at Sault Ste. Marie, Mi. should also include the same concept, or perhaps, a larger "Son of POE Lock" and its impact on the Upper Lakes shipbuilding industry. There is a general rule-of-thumb that "a larger lock will create larger and more efficient vessels". This analysis may also contribute to an improved cost-benefit ratio for the proposed Second Lock if you consider new shipbuilding and improved cargo carrying capacity impact on the Great Lakes region.

One of our "unfinished projects" is the review of waterborne trade through the Chicago connection via the Illinois Waterway and Lake Michigan. According to COE statistics, there are about 8,500 river barges operating through the Chicago waterways to just two major port in Indiana – Burns Harbor and Indiana Harbor. These two ports are served by barge on a year-round basis and connect Inland Waterway destinations/origins providing a water mode service for Seaway commodities as well as domestic commodities. The Illinois Waterway barge traffic generally carries between 42 to 50 millions tons of cargo each year. Recently, the U.S. Coast Guard has published regulations for barges to transit beyond Chicago into Lake Michigan as far as Muskegon, Michigan and Milwaukee, Wisconsin. While this expanded operating capability has been slow developing, the traffic between Chicago and Northern Indiana ports continues to be strong and growing in importance. This route also has its share of infrastructure limitations such as low bridge air draft, narrow channel, and high traffic volume. We recommend that this waterway connection be included in your study effort.

These are just a few of the ideas that we may be able to help you investigate in your study project. Please feel free to contact us at any time if you have any questions. We look forward to providing technical assistance to you and your staff.

Yours truly,

Al Ames
Region Director

Cc: Craig Middlebrook – SLSDC
Bonnie M. Green – MARAD
RADM James D. Hull – USCG Ninth District

Enclosed:
The Great Lakes – A Waterways Management Challenge
MTS – Report to Congress –September 1999
MARAD Annual Report - 1999
Domestic Shipping
MARAD Great Lakes Region

U.S. Department
of Transportation

THE ADMINISTRATOR
Room 5424
400 Seventh Street, S.W.
(202) 366-0118

Saint Lawrence
Seaway Development
Corporation

August 24, 2000

Mr. Daniel E. Steiner, P.E.
Chief, Planning Division and
Navigation Account Manager
U.S. Army Corps of Engineers
Great Lakes and Ohio River Division
P.O. Box 1159
Cincinnati, OH 45201-1159

Dear Mr. ~~Steiner~~, Dan

Thank you for stopping by the office last month. I appreciate your willingness to travel to Washington and to bring key staff from your Chicago and Buffalo offices to meet with my staff. I understand that the meeting was productive. All of us at the Saint Lawrence Seaway Development Corporation (SLSDC) are excited about working with you on this important project.

At the meeting, you requested our comments to your initial scope of study document. We have reviewed the document and have prepared the enclosed comments. Please let us know if you need more information or clarification on any of the points we have raised here. I hope this same spirit of cooperation on the initial scope of work will follow throughout all aspects of the actual study. I would be happy to designate a team of SLSDC employees at your ready for consultation, expertise, facilitation, and a reality check.

We have outlined seven points for consideration, with our chief concern being that the study include a fresh examination of expanding the Seaway's locks. Accurately assessing the feasibility of lock expansion for the entire Seaway System, including both Canadian and U.S. locks, is essential to assessing the long-term competitiveness of the System. The SLSDC can play a crucial role in facilitating the involvement of the Canadian St. Lawrence Seaway Management Corporation (SLSMC) in this study. Indeed, as I believe you are aware, my Canadian counterpart, Guy Véronneau, has stated that while he is eager to participate in this study, Canadian participation is contingent on their ability to work directly through the SLSDC in consulting with your agency. To that end, we will have to establish a procedure for communicating between the SLSMC and your agency through the SLSDC. I am confident that we can arrange a procedure, just as we have done with the U.S. Coast Guard and the SLSMC, that is efficient, yet sensitive to the requirements of each agency. It would be useful to arrange a meeting, when you feel it is appropriate, between you and your staff and the appropriate Canadian representatives. I would propose that the meeting be held at or near our facilities in

Mailing Address: P.O. Box 44090, Washington, D.C. 20026-4090
FAX (202) 366-7147

Massena, NY (which is adjacent to the SLSMC's headquarters in Cornwall, ON). If you agree, I will make arrangements for such a meeting on a date that you request.

As you and I have discussed, another area where we may be of assistance is in providing you with contacts among U.S. Great Lakes/Seaway stakeholders. I know you have already established contacts with some of the key port directors when you met last month in Washington with members of the Association of American Great Lakes' Ports. From that group, Davis Helberg, Executive Director of the Duluth Seaway Port Authority, John Jamian, Executive Director of the Detroit/Wayne County Port Authority (and current president of the American Great Lakes Ports Association), James Hartung, President of the Toledo-Lucas County Port Authority, and Gary Failor, Executive Director of the Cleveland-Cuyahoga Port Authority are individuals you should certainly be in contact with. I would also suggest contacting RADM James Hull, Commander of the USCG's Ninth District, as well as the Maritime Administration's Great Lakes Regional Director, Alpha Ames. We also can provide you with names of helpful individuals from the maritime industry should you so desire. Please let me know how extensive a list of potential contacts you would like. For now, I have enclosed the addresses and phone numbers of the individuals I've mentioned here. We would be happy to facilitate or arrange for meetings with these individuals.

Finally, I want to take this opportunity to invite you formally to our stakeholder meeting in Cleveland on October 18. We hold two such meetings a year with port and industry representatives from all over the Great Lakes, from both the U.S. and Canada. We would be honored to have you be part of the agenda to make a presentation to the group. This would, I believe, be an excellent opportunity for you to meet with and solicit input from some of the major stakeholders in the region. The meeting will be held from 10am to 3pm at the Marriott Residence Inn in downtown Cleveland. Please let me know if you can attend and how much time you would like on the agenda.

I look forward to hearing from you.

Sincerely,

Albert S. Jacquez

Encl.

The Seaway of the 21st Century

Comments of the
Saint Lawrence Seaway Development Corporation
on the scope of the
U.S. Army Corps of Engineers' Reconnaissance Study of Possible
Great Lakes/Seaway Infrastructure Improvements

August 24, 2000

The Saint Lawrence Seaway Development Corporation has been heavily involved in a binational effort to define and promote a strategic plan for the Great Lakes/St. Lawrence Seaway System (System). Under the auspices of the "Waterways Strategic Issues Forum", we have cooperated with the St. Lawrence Seaway Management Corporation (our Canadian counterpart) and various industry representatives to investigate ways to "make the Great Lakes St. Lawrence Waterway the most competitive, technologically advanced, environmentally responsible water transportation system in the world." Some of the elements of this competitive vision can be addressed in the short term, such as controlling costs, strengthening binational cooperation, and investigating new export markets. However, one issue that must be addressed when considering the long term competitiveness of the System is the feasibility of lock expansion to allow for the use of larger, more cost effective vessels. We strongly feel that this reconnaissance study must affirm that the issue of expanding the Seaway locks deserves a fresh look.

The trend in marine transportation is toward larger, more efficient vessels. Currently, the Seaway can only accommodate 40 percent of the world fleet. Ships calling at North America's Gulf and West Coast ports are able to load cargoes of 80,000 to 100,000 tons, whereas the maximum Seaway-draft cargoes are around 25,000 tons. While it is unrealistic to ever think of 100,000 ton cargoes transiting the Seaway, if the locks were modified to accommodate class X vessels, the maximum cargoes would increase dramatically to the vicinity of 60,000 tons. This increase in capacity would decrease the cost per ton by 25 percent based on the vessel utilization savings figures calculated in the 1987 report.

Inspired by the Water Resources and Development Act of 1999, which authorizes the U.S. Army Corps of Engineers in consultation with the SLSDC to examine the feasibility of navigation improvements in the System, we have reviewed the 1987 additional locks study. At the conclusion of the 1987 final feasibility study, the Corps determined that increasing the capacity of the U.S. locks was not economically feasible at that time. In our review, we have identified various issues that we would like to address in the current study reconnaissance phase.

First, we believe that the Corps should closely examine the economic models used in the previous study to determine whether the prior methodology led to an understatement of the true economic benefits to be gained by lock expansion. For instance, we have identified several factors that may have led to underestimating the extent of the "vessel utilization savings" to be gained by using larger ships. First, the vessel utilization savings were calculated based on a maximum draft of 26'. Even at the time of the study, the draft was 26'3", and we are looking into increasing the draft to 26'6" in the near future (possibly as early as the 2001 Navigation

Season), with a final goal of 27'. Each inch of increased draft translates into additional cargo capacity of 100 metric tons for Seaway size vessels, or up to 270 additional metric tons for Class X Poe-sized vessels that are 1000 feet long. Therefore, any future study should calculate vessel utilization savings for drafts of at least 27'.

In addition, the 1987 study focused on grain and iron ore only when computing the projected vessel utilization savings. While "iron ore in, grain out" is a traditional pattern for Seaway cargo, these cargoes only account for 2/3 of the total tonnage shipped through the Seaway. Any study that does not include vessel utilization savings for this other 1/3 of cargo will understate the benefits relative to the cost of the project.

Also, when calculating the vessel utilization savings, the 1987 study estimated future traffic levels for the years 2000-2050 using 1978 levels as a baseline, then making adjustments based on long term commodity forecasts for grain and iron ore. However, the report seems to consider these future traffic levels as independent of any increases made to the capacities of the locks. In other words, those traffic levels will occur whether the locks are expanded or not. However, if increasing the size of the locks decreases the cost per ton of cargo, either more cargo will be attracted to the System, or the cost of alternative transportation will fall from the competitive pressure of lower Seaway costs. Either alternative represents an increase in transportation savings that were not reflected in the 1987 report, and should be considered in an updated study.

We would also suggest, at this early phase, to be as open as possible to different options for increasing lock capacity. Perhaps it might be feasible to increase only one dimension (only length, width or draft). While the transportation savings may be lower for such an option, the decreased cost might lead to a positive benefit/cost ratio.

The 1987 study defined the relevant benefit to transportation improvements, including lock expansion, as U.S. transportation savings. Is it possible to expand this definition of benefit? One obvious concern is the exclusion of Canadian cost and benefits in the analysis. Since only 2 of the 15 locks on the Seaway are within U.S. control, any expansion of capacity on the U.S. side would be of limited value without a corresponding expansion of the Canadian locks. We cannot overemphasize our desire to see that any future study examines costs and benefits on a System-wide basis. We have informed our Canadian counterparts of the upcoming study, and they have expressed their willingness to provide assistance. We will do anything in our power to facilitate binational cooperation in such a study, and we recommend that securing Canadian input in the reconnaissance phase be made a top priority.

In addition, we understand that the current economic protocol followed by the Corps for navigation studies narrowly restricts the benefits used in the benefit/cost analysis to transportation benefits, such as vessel delay savings and vessel utilization savings. Can changes be made to this protocol to allow for the measurement of other economic benefits accruing to the Great Lakes area due to increased use of the Seaway? According to the 1987 study,

> Assuming similar System-wide improvement capabilities, preliminary studies indicated that significant Great Lakes regional benefits could be realized [from

increased lock capacity]. Increased capacity would facilitate waterborne commercial, industrial, and agricultural transportation needs through increased capacity for shipment of future commodity flows resulting from continued growth within the region and increased use of the System. Some associated employment and income, and community developmental benefits might also be expected which would help to stabilize and/or promote continued community and regional socioeconomic growth.

At this early phase, we believe it might be useful to at least discuss a mechanism for quantifying these benefits for inclusion in the benefit/cost ratio.

Historically, the Seaway has played an important role as a conduit for exports from and imports to the nation's heartland. Not only is the Seaway a very cost competitive route for trade between the U.S. and Europe, North Africa and the Mediterranean, it also serves as an important source of extra capacity when surges in commodity movements overwhelm the capacity of rail and barge alternatives. However, the movement toward larger vessels threatens to erode the long term competitiveness of the Seaway as a viable mode of transportation. Faced with similar evidence of the growing dimensions of the world fleet, even the Panama Canal is looking at the option of lock expansion. The 1989 Interim Report on International Fleet Compatibility prepared by the Corps argues that "[c]onstruction of major lock and channel systems are unique in history...Decisions to size locks are almost irreversible." (p. 16, Interim Report) However, it may be time to reexamine this view. We believe that the current reconnaissance study will indeed identify a federal interest in reexamining the feasibility of lock expansion.