# Appendix B –
# Archaeological and Built / Cultural Heritage

# Appendix B-1
# Stage 1 Archaeological Assessment

# Stage 1 Archaeological Assessment Killarney Wharf Redesign and Reconstruction (Killarney Village, Geographical Rutherford Township) District of Sudbury

**Original Report**

Prepared for:

**EXP.**
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# Executive Summary

Archaeological Services Inc. (ASI) was contracted by EXP., on behalf of the Municipality of Killarney, to conduct a Stage 1 Archaeological Assessment (Background Research and Property Inspection) as part of the Killarney Wharf Redesign and Reconstruction project in the District of Sudbury. This project involves the proposed redesign and reconstruction for the municipal wharf in the Killarney Channel off Georgian Bay in Killarney Village.

The Stage 1 Study Area involves the wharves at 11, 17, and 23 Channel Street and Killarney Harbour.

The Stage 1 background study determined no previously registered archaeological sites are located within one kilometre of the Study Area. The property inspection determined that the Study Area does not retain archaeological potential and will not require further archaeological assessment.

1) The Study Area does not retain archaeological potential on account of deep and extensive land disturbance. These lands do not require further archaeological assessment; and,

2) Should the proposed work extend beyond the current Study Area, further archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

# Project Personnel

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# 1.0 Project Context

Archaeological Services Inc. (ASI) was contracted by EXP., on behalf of the Municipality of Killarney, to conduct a Stage 1 Archaeological Assessment (Background Research and Property Inspection) as part of the Killarney Wharf Redesign and Reconstruction project in the District of Sudbury. This project involves the proposed redesign and reconstruction for the municipal wharf in the Killarney Channel off Georgian Bay in Killarney Village.

The Stage 1 Study Area involves the wharves at 11, 17, and 23 Channel Street and Killarney Harbour (Figure 1).

All activities carried out during this assessment were completed in accordance with the *Ontario Heritage Act* (Ontario Heritage Act, R.S.O. c. O.18, 1990, as amended in 2019) and the 2011 *Standards and Guidelines for Consultant Archaeologists* (S & G), administered by the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI 2011).

## 1.1 Development Context

All work has been undertaken as required by the *Environmental Assessment Act, RSO* (Environmental Assessment Act, R.S.O., 1990 as amended 2020) and regulations made under the Act, and are therefore subject to all associated legislation. This project is being conducted in accordance with the Municipal Engineers' Association document *Municipal Class Environmental Assessment* (Municipal Class Environmental Assessment, 2000, as amended 2015).

Authorization to carry out the activities necessary for the completion of the Stage 1 archaeological assessment and property inspection was granted by EXP. on September 2, 2022.

### 1.1.1 Treaties

The Study Area is within the Robinson-Huron Treaty 61. In 1850, the Robinson-Huron treaty was signed in Baawating (Sault Ste. Marie) by the Lake Huron Chiefs and leaders of the Anishinaabeg signatory First Nations ceding the Lake

Huron shoreline, including the islands, from Matchedash Bay to Batchewans Bay, and inland as far as the height of land, for resource extraction and settlement (Surtees, 1986). One of the signatories was Anishinaabe Chief Shingwaukonse (Little Pine) (1773-1854), veteran of the War of 1812 who had helped establish Garden River First Nation. While settlement was restricted to the established reserves, "the full and free privilege to hunt over the territory [then] ceded by them and to fish in the waters thereof as they have heretofore been in the habit of doing" was retained in the Treaty for the first time in treaty making history, as well as cash payment for annuities (Surtees, 1971, 1986).

During the negotiations of the Robinson Treaty, the Métis lost much of their rights, particularly regarding their land, despite having strong support from Chief Shingwaukonse from Garden River. However, regardless of the Crown's treatment of the Métis, the Ojibwe continued to regard the Métis as having the same rights as them (Lytwyn, 1998; Préfontaine, 2003). It was also generally assumed that in spite of the Robinson Treaty, the Métis would continue to have the right to hunt and fish. This was evident in the nineteenth century census data which showed the occupation of many Métis as hunters, fishermen, trappers and traders.

## 1.2 Historical Context

### 1.2.1 Indigenous Land Use and Settlement

Northern Ontario was occupied by human populations much later than the south. The Laurentide glacier would have retreated above the Study Area by approximately 10,500-10,000 before present (B.P.) (Karrow & Warner, 1990, p. Fig 2.9, 2.11). Populations at this time would have been highly mobile, inhabiting a boreal-parkland similar to the modern sub-arctic. By approximately 10,000 B.P., the environment had progressively warmed and populations now occupied less extensive territories (Ellis & Deller, 1990, pp. 62–63).

Between approximately 10,000-5,500 B.P., the Great Lakes basins experienced low-water levels, and many sites which would have been located on those former shorelines are now submerged. This period produces the earliest evidence of heavy wood working tools, an indication of greater investment of

labour in felling trees for fuel, to build shelter, and watercraft production. These activities suggest prolonged seasonal residency at occupation sites. Polished stone and native copper implements were being produced by approximately 8,000 B.P.; the latter was acquired from the north shore of Lake Superior, evidence of extensive exchange networks throughout the Great Lakes region. The earliest evidence for cemeteries dates to approximately 4,500-3,000 B.P. and is indicative of increased social organization, investment of labour into social infrastructure, and the establishment of socially prescribed territories (Brown, 1995, p. 13; Ellis et al., 1990, 2009). By approximately 3,500 B.P., copper implements become common in the areas surrounding Lake Superior, and there is evidence of the exchange of copper into southern Ontario (Wright 2001:261, 262).

Between 3,000-2,500 B.P., populations continued to practice residential mobility and to harvest seasonally available resources, including spawning fish. The Woodland period begins around 2,500 B.P. and exchange and interaction networks broaden at this time (Spence et al., 1990, pp. 136, 138) and by approximately 2,000 B.P., evidence exists for small community camps, focusing on the seasonal harvesting of resources (Spence et al., 1990, pp. 155, 164). As is clear in the detailed ethnographies of Anishinaabeg populations, winter was a period during which some families would depart from the larger group as it was easier to sustain smaller populations (Rogers 1962). It is generally understood that these populations were Algonquian-speakers during these millennia of settlement and land use.

Remains from Laurel-period (2,200–1,200 B.P.) archaeological sites show a strong riverine and lake adaptation. The subsistence strategies during this period involved, like the Archaic period, a wide range of faunal and floral resources. Seasonal gatherings of people for subsistence and social purposes began to occur during this period, resulting in the appearance of large settlements at prime fishing locations. A Middlesex burial mound occurs in the Killarney area northeast of Georgian Bay, and later Laurel mounds are known from the Rainy River area of northwestern Ontario, indicating a strongly developed mortuary practice influenced by the Hopewell groups of the Ohio valley. The grave offerings associated with these burials continued to place an

emphasis upon the exotic origin of raw materials. These developments suggest that changes first evidenced in the preceding Early Woodland period continued to develop and be expanded upon.

Before the European arrival, extensive exchange systems had already developed between the Anishinaabe and Cree of north-central and northeastern Ontario and the Huron-Wendat and other Iroquoian groups to the south. The end of the Late Woodland period in northern Ontario is marked by the appearance of European Trade goods circa 1600 C.E.

### 1.2.2 Post-Contact Settlement

Historically, the Study Area is located in the Geographical Rutherford Township, in Killarney Village.

The S & G stipulates that areas of early Euro-Canadian settlement (pioneer homesteads, isolated cabins, farmstead complexes), early wharf or dock complexes, pioneer churches, and early cemeteries are considered to have archaeological potential. Early historical transportation routes (trails, passes, roads, railways, portage routes), properties listed on a municipal register or designated under the Ontario Heritage Act or a federal, provincial, or municipal historic landmark or site are also considered to have archaeological potential.

For the Euro-Canadian period, the majority of early nineteenth century farmsteads (i.e., those that are arguably the most potentially significant resources and whose locations are rarely recorded on nineteenth century maps) are likely to be located in proximity to water. The development of the network of concession roads and railroads through the course of the nineteenth century frequently influenced the siting of farmsteads and businesses. Accordingly, undisturbed lands within 100 metres of an early settlement road are also considered to have potential for the presence of Euro-Canadian archaeological sites.

The first Europeans to arrive in the area were transient merchants and traders from France and England, who followed Indigenous pathways and set up trading posts at strategic locations along the well-traveled river routes. All of these

occupations occurred at sites that afforded both natural landfalls and convenient access, by means of the various waterways and overland trails, into the hinterlands. Early transportation routes followed existing Indigenous trails, both along the lakeshore and adjacent to various creeks and rivers (ASI 2006).

## Rutherford Township

The Township of Rutherford and George Island was incorporated in 1929. On January 1, 1999, the Township of Rutherford and George Island amalgamated with the unorganized townships of Killarney, Hansen, Goshen, Sale, Attlee, Kilpatrick, Struthers, Allen and Travers, and portions of the unorganized townships of Bigwood, Humboldt and Carlyle, to become the Municipality of Killarney (Municipality of Killarney, 2022).

## Village of Killarney

Killarney was originally known a Shebahonaning, an Ojibwe phrase for canoe passage (Shebahonaning Anishinabek, n.d.). A North West Company fur trading post was established in 1820 by Etienne Augustin Rocbert de la Morandiere and his wife Josephte Sai-sai-go-no-kwe ("woman of the falling snow") are the first settlers and founders of the village. Josephte Sai-sai-go-no-kwe was an adopted niece of Chief Kitchi Bashigigan (Big Gun) and a relative of Chief Tecumseh (Municipality of Killarney, 2015, 2022).

A small group of Indigenous people lived around the trading post. By the 1830s, Jesuit missionaries stationed at Holy Cross Mission in Wiikwemkoong were serving Shebahonaning. The village became an important stopping point on a main route of travel for explorers, mining and logging companies, government officials, business operators, and settlers. Shebahonaning was recognized as an Indigenous settlement with relatively few white settlers (Municipality of Killarney, 2015). Shebahonaning Anishinabek territory is situated west of Point Grondine, south of Atikameksheng and east of Whitefish River Reserves (Shebahonaning Anishinabek, n.d.). When the government signed the 1850 Robinson-Huron treaty with the Ojibwe groups located along Lake Huron, Shebahonaning was not included. The government often treated the community

as a reserve and the people of Shebahonaning were included in the paylists administered under the treaty (Municipality of Killarney, 2015).

A post office opened after some delay in 1854 under the name Killarney. Killarney developed its own economy in blueberries, commercial fishing, logging, and later in mining and tourism industries (Municipality of Killarney, 2015).

### 1.2.3 Map Review

The 1905 Fire Insurance Plans of Killarney (Goad, 1905), 1951 Topographic Map Little Current Sheet (Surveys and Mapping Branch, 1951), and the 1990 National Topographic Series Little Current Sheet (Energy, Mines and Resources Canada, 1990) were examined to determine the presence of historic features within the Study Area during the nineteenth and twentieth centuries (Figures 2-5).

The 1905 map (Figure 2) shows the Study Area south of Channel Street and St. Charles Street, on a wharf on the Killarney Channel. A laneway leads south to an oil house, a shop and post office. Also on the property is a net shed, freight shed, icehouse, fish warehouse, bake house, a storage building, and two unlabelled buildings. South of the buildings is a fish dock. A narrow dock is within the western portion of the Study Area.

The 1951 map (Figure 3) does not depict structures between Channel Street and Killarney Channel within the western portion of the Study Area. The eastern portion is shown to have structures and the wharf. The Study Area is shown to be within the village of Killarney, opposite the north bank of George Island and separated by Killarney Channel.

The 1990 map (Figure 4) shows density in development within the Study Area. The wharf area is labelled “marina.”

### 1.2.4 Orthoimagery Review

A review of available Google satellite imagery shows the Study Area has remained relatively unchanged since 2009.

## 1.3 Archaeological Context

This section provides background research pertaining to previous archaeological fieldwork conducted within and in the vicinity of the Study Area, and its environmental characteristics (including drainage, soils or surficial geology and topography, etc.). Three sources of information were consulted to provide information about previous archaeological research: the site record forms for registered sites available online from the MHSTCI through "Ontario's Past Portal"; published and unpublished documentary sources; and the files of ASI.

### 1.3.1 Geography

In addition to the known archaeological sites, the state of the natural environment is a helpful indicator of archaeological potential. Accordingly, a description of the physiography and soils are briefly discussed for the Study Area.

The S & G stipulates that primary water sources (lakes, rivers, streams, creeks, etc.), secondary water sources (intermittent streams and creeks, springs, marshes, swamps, etc.), ancient water sources (glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels indicated by clear dip or swale in the topography, shorelines of drained lakes or marshes, cobble beaches, etc.), as well as accessible or inaccessible shorelines (high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh, etc.) are characteristics that indicate archaeological potential.

Water has been identified as the major determinant of site selection and the presence of potable water is the single most important resource necessary for any extended human occupation or settlement. Since water sources have remained relatively stable in Ontario since 5,000 B.P. (Karrow & Warner, 1990, fig. 2.16), proximity to water can be regarded as a useful index for the evaluation of archaeological site potential. Indeed, distance from water has been one of the most commonly used variables for predictive modeling of site location.

Other geographic characteristics that can indicate archaeological potential include elevated topography (eskers, drumlins, large knolls, and plateaux), pockets of well-drained sandy soil, especially near areas of heavy soil or rocky ground, distinctive land formations that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases. There may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings. Resource areas, including; food or medicinal plants (migratory routes, spawning areas) are also considered characteristics that indicate archaeological potential (S & G, Section 1.3.1).

The Study Area is within the Canadian Shield region, consisting of bedrock which dominates the landscape from the early Precambrian era. The region has low relief with numerous small lakes and locally abundant outcrops. Sparse forests comprised of black spruce, balsam fir and tamarack are typical of the Canadian Shield. Parts of the area is covered by drumlins and glacial till, with overburden from one to ten metres deep (Fladgate Exploration Consulting Corporation, 2012, p. 26).

The surficial geology demonstrates that the Study Area is underlain by clayey till (Ontario Department of Lands and Forests, 1962).

Soil within the Study Area consists of Class 7, soils unusable for cultivation or permanent pasture, including rockland and non-soil areas (Soil Research Institute, 1969).

The Study Area includes the Killarney Channel, which separates George Island from the village of Killarney off Georgian Bay. Channel Marina in Killarney Channel undergoes regular dredging to keep up with declining water levels (McKay, 2013). The Study Area is within the Lake Huron watershed.

The Lake Huron watershed has an area of 134,100 kilometres squared, and a shoreline length of 6,164 kilometres, the largest area and longest shoreline of the Great Lakes. The Lake Huron watershed is second in terms of surface area, coming in at 59,565 kilometres squared. The North Channel, Georgian Bay, Main Basin, and Saginaw Bay make up the four interacting bodies of water which make up Lake Huron. The lake receives its water from Lake Michigan through

the Straights of Mackinac, and form Lake Superior through the St. Marys River. The rocky shores associated with Precambrian shield cover the northern and eastern shores of Georgian Bay and the North Channel (Lake Huron Framework, 2002).

### 1.3.2 Previously Registered Archaeological Sites

In Ontario, information concerning archaeological sites is stored in the Ontario Archaeological Sites Database maintained by the MHSTCI. This database contains archaeological sites registered within the Borden system. Under the Borden system, Canada has been divided into grid blocks based on latitude and longitude. A Borden block is approximately 13 kilometres east to west, and approximately 18.5 kilometres north to south. Each Borden block is referenced by a four-letter designator, and sites within a block are numbered sequentially as they are found. The Study Area under review is located in Borden block *BlHj.*

According to the Ontario Archaeological Sites Database, no previously registered archaeological sites are located within one kilometre of the Study Area.

### 1.3.3 Previous Archaeological Assessments

According to the background research, no previous reports detail fieldwork within 50 metres of the Study Area.

# 2.0 Property Inspection

## 2.1 Field Methods

A Stage 1 property inspection must adhere to the S & G, Section 1.2, Standards 1-6, which are discussed below. The entire property and its periphery must be inspected. The inspection may be either systematic or random. Coverage must be sufficient to identify the presence or absence of any features of archaeological potential. The inspection must be conducted when weather conditions permit good visibility of land features. Natural landforms and watercourses are to be confirmed if previously identified. Additional features such as elevated topography, relic water channels, glacial shorelines, well-

drained soils within heavy soils and slightly elevated areas within low and wet areas should be identified and documented, if present. Features affecting assessment strategies should be identified and documented such as woodlots, bogs or other permanently wet areas, areas of steeper grade than indicated on topographic mapping, areas of overgrown vegetation, areas of heavy soil, and recent land disturbance such as grading, fill deposits and vegetation clearing. The inspection should also identify and document structures and built features that will affect assessment strategies, such as heritage structures or landscapes, cairns, monuments or plaques, and cemeteries.

The Stage 1 archaeological assessment property inspection was conducted under the field direction of Martin S. Cooper, MA (P380) of ASI, on October 14, 2022, in order to gain first-hand knowledge of the geography, topography, and current conditions and to evaluate and map archaeological potential of the Study Area. It was a systematic visual inspection from publicly accessible lands/public right-of-ways only and did not include excavation or collection of archaeological resources. Fieldwork was conducted when weather conditions were deemed clear with good visibility (overcast and seven degrees Celsius), per S & G Section 1.2., Standard 2. Field photography is presented in Section 7.0 (Image 1 to Image 8), and field observations are overlaid onto the existing conditions of the Study Area in Section 8.0 (Figure 5).

## 2.2 Current Land Use and Field Conditions

The Study Area is comprised of the existing wharf in the Killarney Channel at 11, 17, and 23 Channel Street. This area includes the Channel Marina, a seasonal business operating May to September with an ice cream parlour, convenience store, marine rentals, a retaining wall with launch stairs, and a dock system with space for 22 boats for seasonal and short-term docking. As well, commercial buildings including Herbert Fisheries restaurant and a LCBO. A large propane tank is on the property between the Herbert Fisheries restaurant and a small shed. The wharf allows for boats to dock west and south of the properties within the channel. The wharf includes a retaining crib with round timbers and concrete blocks, a slip deck with wire mesh, small stone fill, and concrete blocks, reinforced concrete beams, and concrete fender (Appendix A: Figure 6 to Figure

7). Dredging frequently occurs within the Killarney Channel to keep up with declining water levels.

# 3.0 Analysis of Archaeological Potential

The S & G, Section 1.3.1, lists criteria that are indicative of archaeological potential. The Study Area meets the following criteria indicative of archaeological potential:

- Water sources: primary, secondary, or past water source (Georgian Bay, Killarney Channel);
- Proximity to early settlements (Killarney); and
- Early historic transportation routes (Channel Street, St. Charles Street)

According to the S & G, Section 1.4 Standard 1e, no areas within a property containing locations listed or designated by a municipality can be recommended for exemption from further assessment unless the area can be documented as disturbed. The Municipal Heritage Register was consulted and no property within the Study Area is Listed or Designated under the *Ontario Heritage Act*.

Part of the Study Area includes the Killarney Channel waterbody (Figure 5: area highlighted in blue). The potential for marine archaeological resources has not been evaluated as part of this land based archaeological assessment report. However, the *Criteria for Evaluation Marine Archaeological Potential: A Checklist for Non-Marine Archaeologists* was completed for the area of potential in-water impacts. The checklist determined the area of potential in-water impacts has low marine archaeological potential and therefore no marine assessment is required.

The property inspection confirmed that the Study Area has been subjected to deep soil disturbance events due to construction of the wharf (Appendix A: Figure 6 to Figure 7) including retaining crib and slip deck, and construction of Channel Street right-of-way. According to the S & G Section 1.3.2 these areas do not retain archaeological potential (Images 1-15; Figure 5: areas highlighted in yellow) and do not require further survey.

## 3.1 Conclusions

The Stage 1 background study determined no previously registered archaeological sites are located within one kilometre of the Study Area. The property inspection determined that the Study Area does not retain archaeological potential and will not require further archaeological assessment (Figure 5: areas highlighted in yellow).

# 4.0 Recommendations

The following recommendations are made:

1) The Study Area does not retain archaeological potential on account of deep and extensive land disturbance (Figure 5: areas highlighted in yellow). These lands do not require further archaeological assessment; and,

2) Should the proposed work extend beyond the current Study Area, further archaeological assessment should be conducted to determine the archaeological potential of the surrounding lands.

**NOTWITHSTANDING** the results and recommendations presented in this study, ASI notes that no archaeological assessment, no matter how thorough or carefully completed, can necessarily predict, account for, or identify every form of isolated or deeply buried archaeological deposit. In the event that archaeological remains are found during subsequent construction activities, the consultant archaeologist, approval authority, and the Archaeology Programs Unit of the Ministry of Heritage, Sport, Tourism and Culture Industries should be immediately notified.

The above recommendations are subject to Ministry approval and it is an offence to alter any archaeological site without Ministry of Heritage, Sport, Tourism and Culture Industries concurrence. No grading or other activities that may result in the destruction or disturbance of any archaeological sites are permitted until notice of MHSTCI approval has been received.

# 5.0 Legislation Compliance Advice

ASI advises compliance with the following legislation:

- This report is submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, RSO 2005, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological field work and report recommendations ensure the conservation, preservation, and protection of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Heritage, Sport, Tourism and Culture Industries, a letter will be issued by the Ministry stating that there are no further concerns with regards to alterations to archaeological sites by the proposed development.

- It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological field work on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*.

- Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with sec. 48 (1) *of the Ontario Heritage Act*.

- The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33, requires that any person discovering or having knowledge of a burial site shall immediately notify the police or coroner. It is recommended that the

Registrar of Cemeteries at the Ministry of Consumer Services is also immediately notified.

- Archaeological sites recommended for further archaeological field work or protection remain subject to Section 48(1) of the *Ontario Heritage Act* and may not be altered, nor may artifacts be removed from them, except by a person holding an archaeological license.

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# 7.0 Images

## 7.1 Field Photography



**Image 1 Area is disturbed,no potential**



**Image 2 Existing wharf is disturbed, no potential**



**Image 3 Area is disturbed,no potential**



**Image 4 Existing wharf is disturbed, no potential**



**Image 5 Area is disturbed,no potential**



**Image 6 Existing wharf is disturbed, no potential**




**Image 7 Area is disturbed,no potential**



**Image 8 Existing wharf is disturbed, no potential**

# 8.0 Maps




**Figure 1 Killarney Wharf Redesign and Reconstruction Study Area**

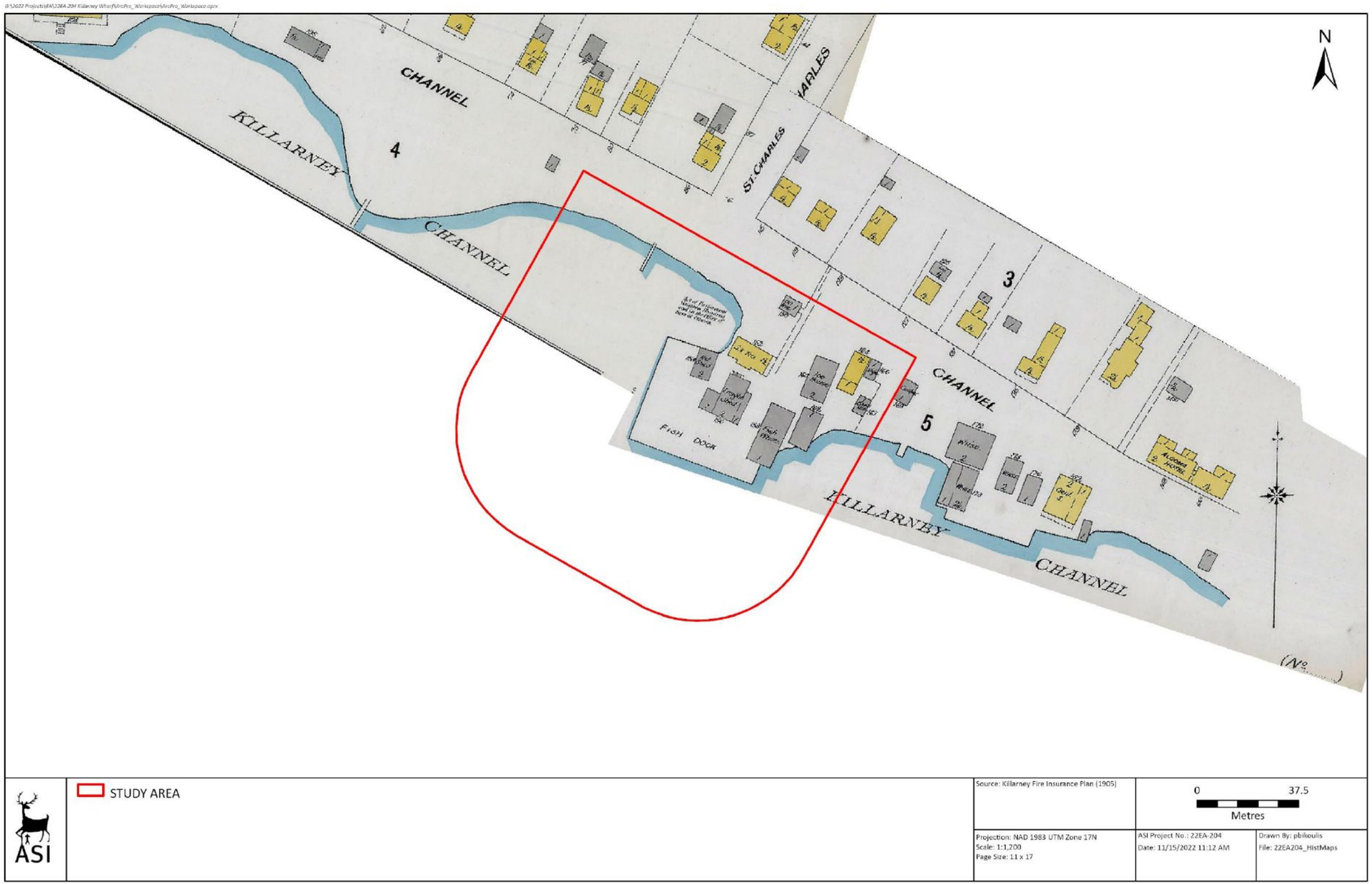



**Figure 2 Study Area (Approximate Location) Overlaid on the 1905 Fire Insurance Plan of Killarney**

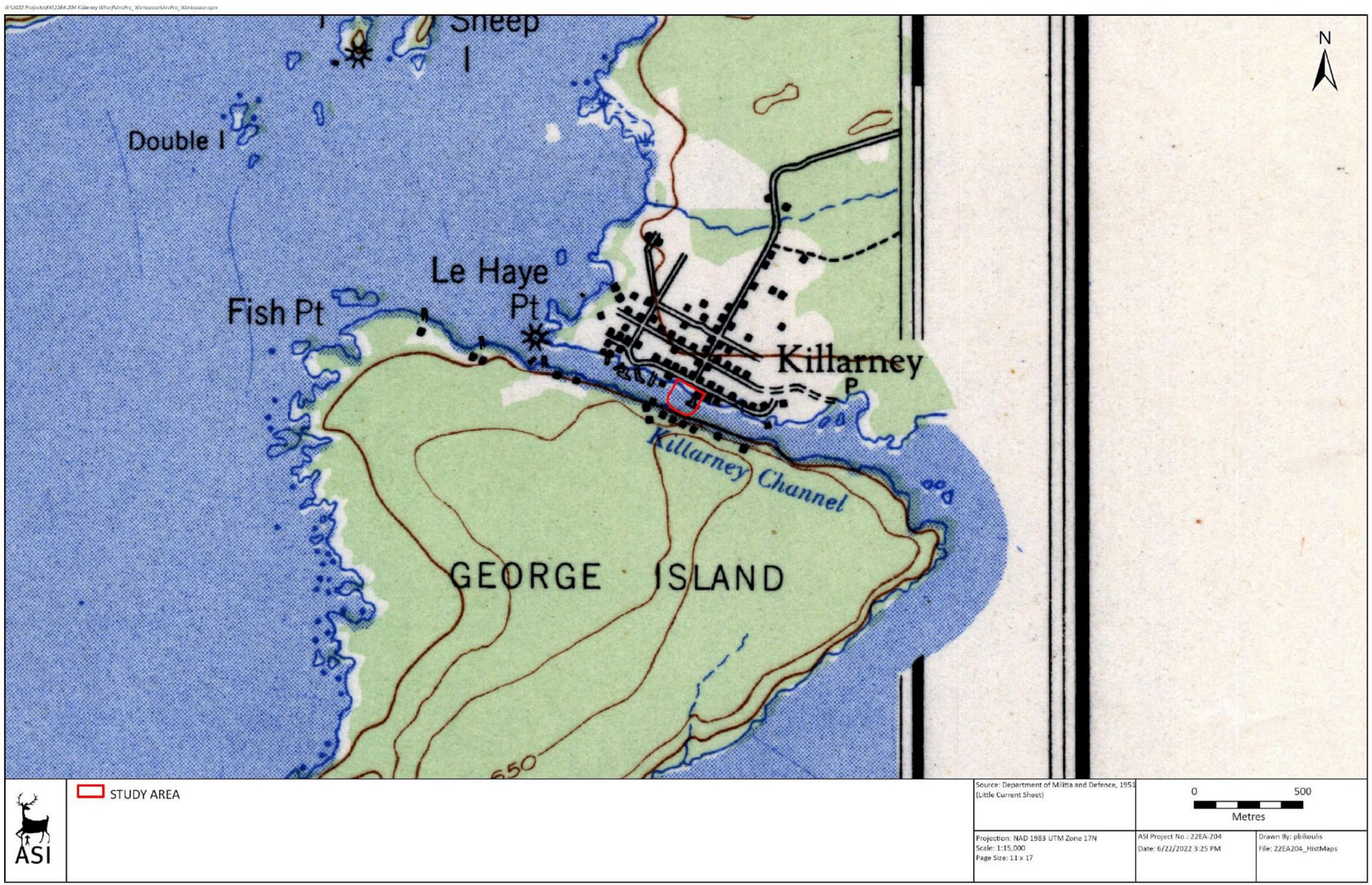



**Figure 3 Study Area (Approximate Location) Overlaid on the 1951 Topographic Map Little Current Sheet**

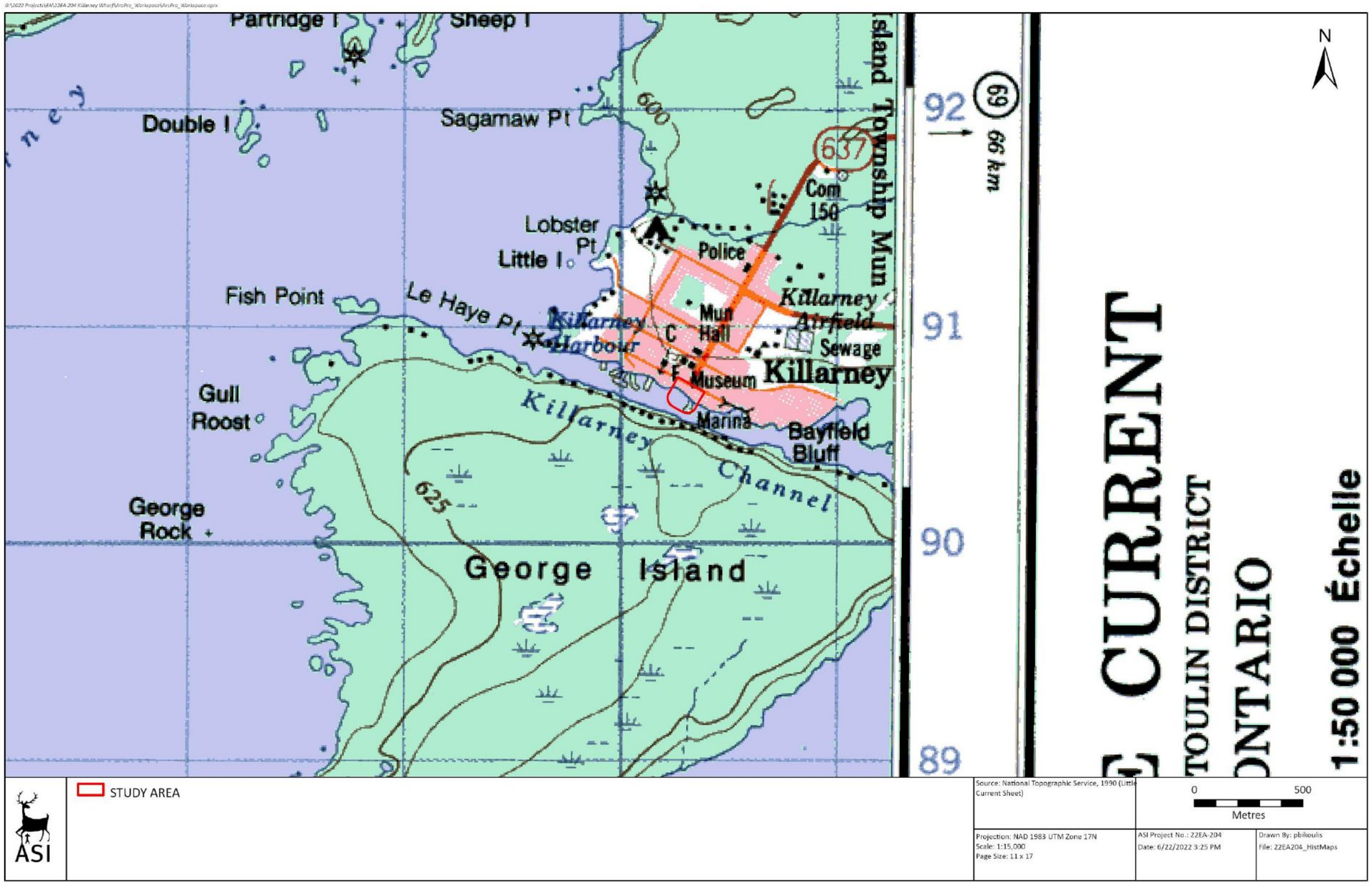



**Figure 4 Study Area (Approximate Location) Overlaid on the 1990 National Topographic Series Little Current Sheet**




**Figure 5 Study Area – Stage 1 Results**

# Appendix A: Construction Drawings From 1951

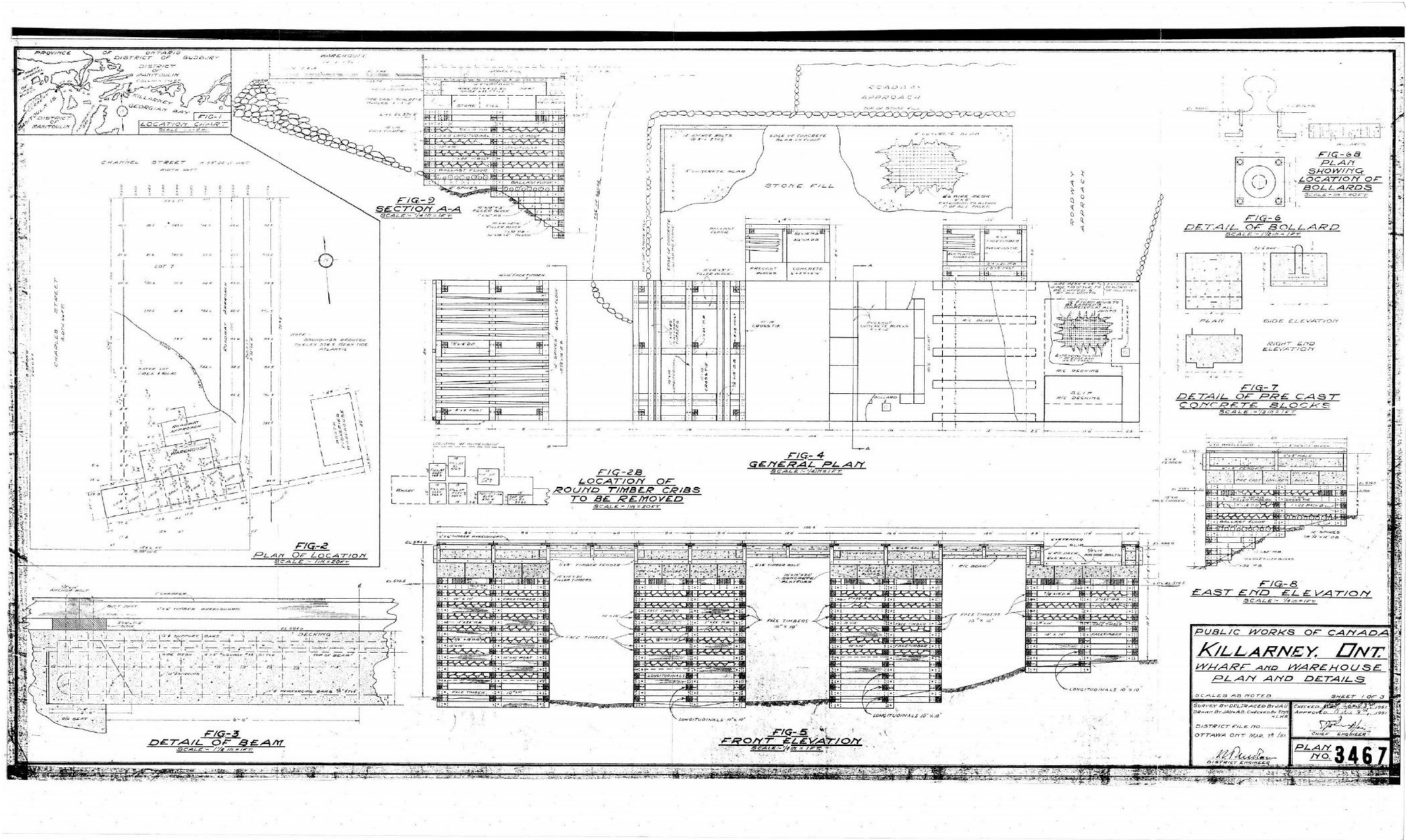



**Figure 6 Wharf and Warehouse – General Plan**

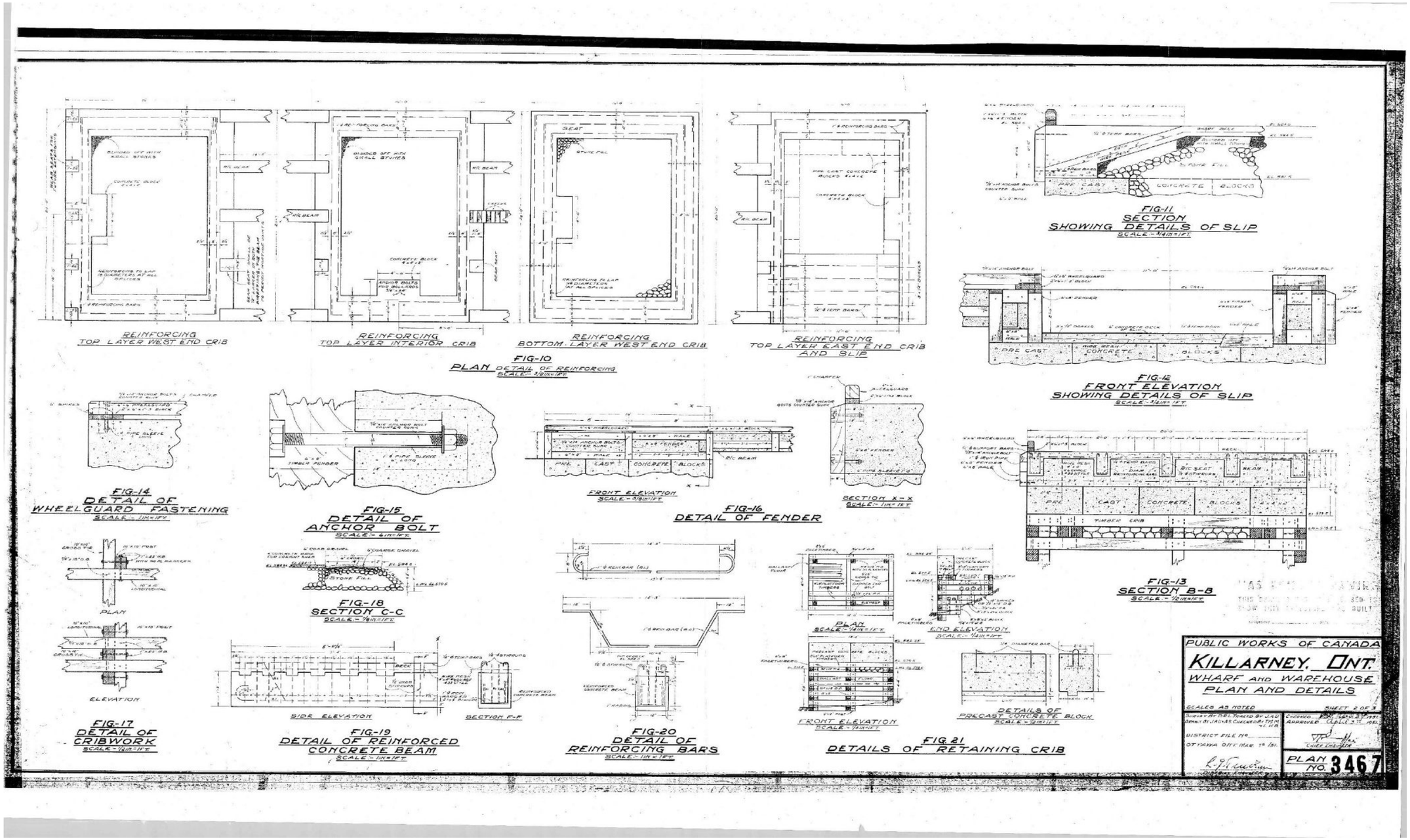



**Figure 7 Wharf and Warehouse - Details**

# Appendix B-2
# Criteria for Evaluation Marine Archaeological Potential: A Checklist for Non-Marine Archaeologists

Note: Please see correspondence dated July 10, 2024 from EXP to MCM in Appendix B-4 for the following supportive documentation for previous extensive disturbance in the marine environment near the project area:

- Aerial images depicting the project area, overlain with extracts from maps and drawings from between the years 1905 to 2013.
- Copy of the Public Works of Canada “Wharf and Warehouse Plans and Details” sheets (1951).
- Copy of the 1974 United States Environmental Protection Agency document “Future Dredging Quantities in the Great Lakes”.

Ontario

**Ministry of Tourism, Culture and Sport**

Programs & Services Branch
401 Bay Street, Suite 1700
Toronto ON M7A 0A7

# Criteria for Evaluating Marine Archaeological Potential

## A Checklist for Non-Marine Archaeologists

## Purpose

The **purpose of this checklist** is to help proponents determine:

- if a property or project area may contain marine archaeological resources or have marine archaeological potential

A marine archaeological site is fully or partially submerged, or lies below or partially below the high-water mark of any body of water.

The property or project area includes all submerged areas that may be impacted by project activities, including, but not limited to:

- the main project area
- temporary storage and stockpiling locations
- staging and work areas, such as docking platforms and dredging locations
- temporary features such as access routes, anchors, moorings and cofferdams.

Please refer to the **instructions** on pages 4 through 9 when completing this checklist

## Processes covered

- *Planning Act*
- *Environmental Assessment Act*
- *Aggregate Resources Act*
- *Ontario Heritage Act*
  - Standards & Guidelines for Conservation of Provincial Heritage Properties
- *Canadian Environmental Assessment Act*
- *Canada Shipping Act*

## Marine archaeological assessment

The assessment will help you:

- identify, evaluate and protect marine archaeological resources on your property or project area
- reduce potential delays and risks to your project

If you are not sure how to answer one or more of the questions on the checklist, you may want to hire a licensed marine archaeologist (defined on page 5) to undertake a marine archaeological assessment.

Note: Under Part VI of the *Ontario Heritage Act*, all marine archaeological assessments **must** be done by a licensed marine archaeologist. Only a licensed marine archaeologist can assess – or alter – a marine archaeological site.

## Have you found a site?

If you find something you think may be of marine archaeological value during project work, you **must** – by law – stop all activities immediately and contact a licensed marine archaeologist. The marine archaeologist will carry out the fieldwork in compliance with the *Ontario Heritage Act*.

## Have you found human remains?

If you find remains (e.g., bones) that could be of human origin, you **must** – by law - immediately notify the appropriate authorities (police, coroner's office, or Registrar of Cemeteries) and comply with the *Funeral, Burial and Cremation Services Act*.

## Other Checklists

Please use a separate checklist for your project if:

- your Parent Class EA document has approved screening criteria
- your ministry's or prescribed public body's approved Identification and Evaluation Process includes approved screening criteria

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Project or Property Name

Killarney Municipal Wharf

Project or Property Location (upper and lower or single tier municipality)

21 Channel Street South, Killarney

Proponent Name

Municipality of Killarney, Kelly Champaigne - Project Manager

**Proponent Contact Information**

| Telephone Number | Fax Number | Email Address |
|---|---|---|
| (705) 287-2424 | (705) 287-2660 | kchampaigne@municipalityofkillarney.ca |

## Screening Questions

1. Is there a government-authorized, pre-approved screening checklist, methodology or process in place?

☐ Yes ☑ No

If **Yes**, please follow the pre-approved screening checklist, methodology or process. Do not complete the rest of this checklist.

If **No**, continue to Question 2.

2. Has a marine archaeological assessment been prepared for the property or project area and been entered by MTCS into the Ontario Public Register of Archaeological Reports?

☐ Yes ☑ No

If **Yes**, do **not** complete the rest of the checklist. You are expected to follow the recommendations in the marine archaeological assessment report(s).

The proponent and/or approval authority will:

- summarize the previous marine archaeological assessment
- follow any recommendations for further marine archaeological assessment work, as applicable
- add this checklist to the project file, with the appropriate documents that demonstrate a marine archaeological assessment was undertaken (e.g. MTCS letter that states that the report has been entered into the Ontario Public Register of Archaeological Reports)

The summary and appropriate documentation may be:

- submitted as part of a report requirement, e.g. environmental assessment document
- maintained by the proponent or approval authority

If **No**, continue to Question 3.

3. Are there known marine or land-based archaeological sites on or within 500 metres of the property or project area?

☐ Yes ☑ No

4. Is there Aboriginal or local knowledge of marine or land-based archaeological sites on or within 500 metres of the property or project area?

☐ Yes ☑ No

5. Is there Aboriginal knowledge or historically documented evidence of past Aboriginal use on or within 500 metres of the property or project area?

☐ Yes ☑ No

6. Is there a known burial site or cemetery on the property or adjacent to the property or project area?

☐ Yes ☑ No

7. Has the property or project area been recognized for its cultural heritage value?

☐ Yes ☑ No

If **Yes** to any of questions 3 to 7, do **not** complete the checklist. Your property or project area could contain marine archaeological resources: please hire a licensed marine archaeologist to conduct a marine archaeological assessment.

If **No**, continue to Question 8.

8. Has the entire property or project area been subjected to recent, extensive and intensive disturbance?

☑ Yes ☐ No

If **Yes**, do **not** complete the checklist. Instead, please keep and maintain a summary of documentation that provides evidence of the recent disturbance. A marine archaeological assessment is not required.

If **No**, continue to Question 9.

9. Are there two or more reported or registered ship wreck sites or reports of lost ships within a five kilometre radius of the property or project area?

☐ Yes ☐ No

If **Yes**, a marine archaeological assessment is required.

If **No**, continue to Question 10.

10. Is the property or project area within one kilometre of an active or historic harbour, seaplane or floatplane base, tunnel, ferry route, marine terminal, or winter road?

☐ Yes ☐ No

If **Yes**, a marine archaeological assessment is required.

If **No**, continue to Question 11.

11. Where the project impacts fourth order or higher watercourses, are there existing narrows, rapids, waterfalls or does the watercourse enter or leave a body of water within 300 metres of the property or project area?

☐ Yes ☐ No

If **Yes**, a marine archaeological assessment is required.

If **No**, continue to Question 12.

12. Are there potential built heritage or cultural heritage landscape resources that may be of cultural heritage value or interest adjacent to the watercourse or water body?

☐ Yes ☐ No

If **Yes**, a marine archaeological assessment is required.

If **No**, continue to Question 13.

13. Are there inundated beaches, bluffs, lakeshores, streams or river banks within 300 metres of the property or project area?

☐ Yes ☐ No

If **Yes**, a marine archaeological assessment is required.

If **No**, continue to Question 14.

14. Are there inundated beaches, lakeshores or river/creek banks beyond 300 metres and at greater depth than the project area with evidence of two or more of the following in the project area?

- elevated bathymetric features such as drumlins, eskers, kames, ridges, etc.
- pockets of sandy lakebed
- distinctive bathymetric formations such as escarpments, shoals, promontories, reefs, etc.
- inundated resource extraction areas (quarry, fishery)
- inundated historical settlement including built heritage resources or cultural heritage landscapes
- inundated historical transportation routes

☐ Yes ☐ No

If **Yes**, a marine archaeological assessment is required.

If **No**, there is low potential for marine archaeological resources at the property (or project area).

The proponent, property owner and/or approval authority will:

- summarize the conclusion
- add this checklist with the appropriate documentation to the project report or file

The summary and appropriate documentation may be:

- submitted as part of a report requirement, e.g. under the *Environmental Assessment Act*, *Planning Act* processes
- maintained and retained by the property owner, proponent or approval authority

## Instructions

Please have the following available, when requesting information related to the screening questions:

- a clear map or chart showing the location and boundary of the property or project area
  - large scale and small scale maps/charts showing nearby islands or township names for context
- the municipal addresses of all properties or water lots within or adjacent to the project area, if any
- the lot, concession, parcel number or mining claims of any properties within the project area

In this context, the following definitions apply:

- **licensed marine archaeologist** means an archaeologist who has a valid marine archaeology licence issued by the Ministry of Tourism, Culture and Sport to practice in Ontario. As a consultant, a licensed marine archaeologist enters into an agreement with a client to carry out or supervise marine archaeological work on behalf of the client, produce reports for or on behalf of the client and provide technical advice to the client.
- **proponent** means a person, agency, group or organization that carries out or proposes to carry out an undertaking or is the owner or person having charge, management or control of an undertaking.

1. Is there a pre-approved screening checklist, methodology or process in place?

An existing checklist, methodology or process may be already in place to identify marine archaeological potential, including:

- one prepared and adopted by the municipality, such as an archaeological management plan
- an environmental assessment process, such as a screening checklist for municipal bridges
- projects being reviewed under the Canadian *Environmental Assessment Act*.
- one that is approved by the Ministry of Tourism, Culture and Sport under the Ontario government's Standards & Guidelines for Conservation of Provincial Heritage Properties [s. B.2.]

2. Has a marine archaeological assessment been prepared for the property or project area and been entered into the Ontario Public register of Archaeological Reports?

Respond 'yes' to this question, if all of the following are true:

- a marine archaeological assessment report has been prepared and complies with MTCS requirements
  - a letter has been sent by MTCS to the licensed marine archaeologist confirming that MTCS has entered the report into to the Ontario Public Register of Archaeological Reports (Register)
- the report contains a recommendation stating that there are no further concerns regarding impacts to marine archaeological sites

If a marine archaeological assessment report has been completed and deemed compliant by MTCS, and the report contains a recommendation that further marine archaeological assessment work be undertaken, this work will need to be completed.

For more information about previously conducted marine archaeological assessments, contact:

- approval authority (such as a municipality or conservation authority)
- proponent for whom the marine archaeological assessment was carried out
- consultant archaeologist qualified to hold a marine archaeology licence in Ontario
- Ministry of Tourism, Culture and Sport at archaeology@ontario.ca

3. Are there known marine or land-based archaeological sites on or within 500 metres of the property or project area?

MTCS maintains a database of marine and land-based archaeological sites reported to the ministry. Land-based archaeological sites may extend into adjacent waterbodies.

For more information, contact MTCS Archaeological Data Coordinator at archaeology@ontario.ca.

4. Is there Aboriginal or local knowledge of marine or land-based archaeological sites on or within 500 metres of the property or project area?

Check with:

- Aboriginal communities in your area
- local municipal staff

Aboriginal communities may have knowledge that can contribute to the identification of cultural heritage resources, and we suggest that any engagement with Aboriginal communities includes a discussion about known or potential cultural heritage resources that are of value to these communities. Aboriginal communities and local municipal staff may have information about marine archaeological sites that are not included in the MTCS database or reported to the ministry.

Other sources of local knowledge include the following:

- property owner
- local heritage organizations and historical societies, Association for Great Lakes Maritime History
- local and provincial dive organizations (Save Ontario Shipwrecks, Ontario Underwater Council), Preserve Our Wrecks, Ontario Marine Heritage Committee)
- local dive shops
- local amateur divers and diving associations
- local museums
- municipal heritage committees
- published local histories

5. Is there Aboriginal knowledge or historically documented evidence of past Aboriginal use on or within 500 metres of the property or project area?

Check with:

- Aboriginal communities in your area
- local municipal staff

Other sources of local knowledge include the following:

- property owner
- local heritage organizations and historical societies
- local museums
- municipal heritage committees
- published local histories

6. Is there a known burial site or cemetery on the property or adjacent to the property or project area?

For more information on known cemeteries or burial sites contact the following:

- Cemeteries Regulation Unit, Ontario Ministry of Consumer Services – for database of registered cemeteries
- Ontario Genealogical Society (OGS) – to locate records of Ontario cemeteries, both currently and no longer in existence; cairns, family plots and burial registers
- Canadian County Atlas Digital Project – to locate early cemeteries

In this context, ‘adjacent’ means ‘contiguous’, or as otherwise defined in a municipal official plan.

When wrecks are associated with a loss of life, the area in the vicinity of the wreck may be established as a cemetery.

7. Has the property or project area been recognized for its cultural heritage value?

There is a strong chance there may be marine archaeological resources on the property or project area if it has been listed, designated or otherwise identified as being of cultural heritage value by:

- Municipal government
- Ontario government
- Canadian government

This includes a property that is:

- designated under *Ontario Heritage Act* (the OHA ), including:
  - individual designation (Part IV)
  - part of a heritage conservation district (Part V)
  - a land or marine archaeological site (Part VI)
- subject to:
  - an agreement, covenant or easement entered into under the OHA (Parts II or IV)
  - a notice of intention to designate (Part IV)
  - a heritage conservation district study area by-law (Part V) of the OHA
- included on:
  - a municipal register or inventory of heritage properties
  - Ontario government's list of provincial heritage properties
  - Federal government's list of federal heritage buildings
- part of a:
  - National Historic Site
  - UNESCO World Heritage Site
- designated under:
  - *Heritage Railway Station Protection Act*
  - *Heritage Lighthouse Protection Act*
- subject of a municipal, provincial or federal commemorative or interpretive plaque.

To determine if your property or project area is covered by any of the above, see:

- Part A of the MTCS Criteria for Evaluating Potential for Built Heritage and Cultural Heritage Landscapes

**Part VI – Archaeological Sites**
Includes three marine archaeological sites prescribed under Ontario Regulation 11/06 and five terrestrial archaeological sites designated by the Minister under Regulation 875 of the Revised Regulation of Ontario, 1990.

For more information, refer to Regulation 875 and Ontario Regulation 11/06.

8. Has the entire property or project area been subjected to recent, extensive and intensive disturbance?

Recent: after-1960

Extensive: over all or most of the area

Intensive: thorough or complete disturbance

Examples of ground disturbance include:

- quarrying
- dredging
- structural footprints and associated construction areas
    - where the structure has deep foundations or footings
- infrastructure development such as:
    - dams
    - pipelines, hydro lines or other utility trenches
    - causeways
    - bridges

Note: this applies only to the excavated part of the right-of-way or corridor as the remainder may not be impacted

A ground disturbance does not include:

- aqua-cultural activities, such as a fish farm
- areas of traditional or commercial harvesting of fish, shellfish or water-based vegetation
- traditional agricultural areas that have been inundated

Property (Project Area) Inspection

Some documentation may provide evidence of prior disturbance, such as:

- photographs
- maps
- detailed descriptions and blueprints of prior projects

If complete disturbance isn't clear from documents available, an archaeologist licensed for marine archaeology can be hired to undertake an underwater and/or remote-sensing inspection of the study area to determine whether there is any remaining marine archaeological potential.

9. Are there two or more reported or registered ship wreck sites or reports of lost ships within a five kilometre radius of the property or project area?

The presence of two or more ship wreck sites or reports of lost ships in the vicinity may indicate increased marine archaeological potential for additional marine wrecks.

10. Is the property or project area within one kilometre of an active or historic harbour, seaplane or floatplane base, tunnel, ferry route, marine terminal, or winter road?

Focussed areas of marine activity on- and off-shore are indicators for potential marine archaeology due to:

- deliberate structures built in or on the water, such as:
    - mooring and anchoring structures
    - weirs, piers, docks, cribwork
    - groynes, breakwaters, artificial reefs
    - vessels scuttled for utilitarian or other purposes
    - infrastructure related to the construction or operation of a facility like marine railways
- incidental features, such as:
    - beached or sunken vessels or aircraft
    - dropped objects

As a result, there is potential for marine archaeological features or artifacts.

11. Where the project impacts fourth order or higher watercourses, are there existing narrows, rapids, waterfalls or does the watercourse enter or leave a body of water within 300 metres of the property or project area?

Fourth order and higher watercourses (on the Strahler scale) have potential association with human activity around narrows, rapids, waterfalls and proximity to waterbodies such as lakes due to:

- fish harvesting and related dams or weirs
- portage locations for navigable waterways
- early historical fording locations
- early historical water power sources for mills

These activities may result in marine archaeological features or artifacts.

12. Are there potential built heritage or cultural heritage landscape resources that may be of cultural heritage value or interest adjacent to the watercourse or water body?

Euro-Canadian settlement immediately adjacent to water bodies or watercourses may be focussed on the water for specific industrial, commercial or residential uses resulting in marine archaeological features or artifacts. For guidance, see the MTCS Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes

13. Are there inundated beaches, bluffs, lakeshores, streams or river banks within 300 metres of the property or project area?

The margins of water bodies are associated with past human occupations and use of the land. About 80-90% of archaeological sites are found within 300 metres of water bodies.

- water body types:
  - primary - lakes, rivers, streams, creeks
  - secondary - springs, marshes, swamps and intermittent streams and creeks
- water bodies can include constructed water bodies or watercourses, such as:
  - temporary channels for surface drainage
  - rock chutes and spillways
- Accessible or inaccessible shorelines can also have archaeological potential, for example:
  - high bluffs or cliffs
  - sandbars

You can get information about inundated shoreline features through:

- a site visit
- aerial photographs
- bathymetric data
- geological and physiographic studies

14. Are there inundated beaches, lakeshores or river/creek banks beyond 300 metres and at greater depth than the project area with evidence of two or more of the following in the project area?

- elevated bathymetric features such as drumlins, eskers, kames, ridges, etc.
- pockets of sandy lakebed
- distinctive bathymetric formations such as escarpments, shoals, promontories, reefs, etc.
- inundated resource extraction areas (quarry, fishery)
- inundated historical settlement including built heritage resources or cultural heritage landscapes
- inundated historical transportation routes

Landforms associated with past human occupations that have later been inundated, as historically documented or demonstrated through water-level chronologies, retain their archaeological potential.

- **Elevated bathymetric features**
  Higher ground and elevated positions, surrounded by low or level topography, often indicate past settlement and land use. Features such as eskers, drumlins, sizeable knolls, plateaus next to lowlands or other such features are a strong indication of archaeological potential.
  Find out if your property or project area had elevated topography prior to inundation through:
  - nautical charts
  - bathymetric data

- **Pockets of sandy lakebed**

  Areas of sandy soil, prior to being inundated, that would be well-drained and in areas characterized by heavy soil or rocky ground may indicate archaeological potential

  Find out if your property or project area had sandy soil through:

  - site visits
  - lakebed studies and sediment borehole data

- **Distinctive bathymetric formations**

  Distinctive land formations include – but are not limited to:

  - waterfalls
  - rock outcrops or faces
  - caverns
  - mounds

  Prior to inundation such features were often important to past inhabitants as special or sacred places. The following sites may be present at – or close to – these formations:

  - burials
  - structures
  - offerings
  - rock paintings or carvings

  Find out if your property or project area has a distinctive land formation through:

  - site visits
  - aerial photographs
  - bathymetric data

- **Inundated resource extraction areas**

  Prior to inundation, the following resources were collected in these extraction areas:

  - food or medicinal plants e.g. migratory routes, spawning areas, prairie
  - scarce raw materials e.g. quartz, copper, ochre or outcrops of chert
  - resources associated with early historic industry e.g. fur trade, logging, prospecting, mining

  Aboriginal communities may hold traditional knowledge about their past use or resources in the area.

- **Inundated early historic settlement**

  Early Euro-Canadian settlements include – but are not limited to:

  - early military or pioneer settlement, e.g. pioneer homesteads, isolated cabins, farmstead complexes
  - early wharf or dock complexes
  - pioneers churches and early cemeteries

- **Inundated early historic transportation routes** - such as trails, passes, roads, railways, portage routes, canals.

  For more information, see:

  - historical maps or atlases
    - for information on early settlement patterns such as trails (including Aboriginal trails), monuments, structures, fences, mills, historic roads, rail corridors, canals, etc.
    - Archives of Ontario holds a large collection of historical maps and atlases
    - digital versions of historical atlases are available on the Canadian County Atlas Digital Project
  - commemorative markers or plaques such as those posted by local, provincial or federal agencies
  - municipal heritage committees or other local heritage organizations
    - for information on early historic settlements or landscape features (e.g. fences, mill races)
    - for information on commemorative markers or plaques

# Appendix B-3
# Cultural Heritage Evaluation Report

# Cultural Heritage Evaluation Report

# Killarney Wharf

# Municipality of Killarney, Ontario

**Final Report**

Prepared for:

**EXP Services Inc.**
885 Regent Street, Suite 3-6A
Sudbury, ON P3E 5M4
T 705-674-9681

Archaeological Services Inc. File: 24CH-229

April 2025 (finalized January 2026)



# Executive Summary

Archaeological Services Inc. was contracted by EXP Services Inc. to conduct a Cultural Heritage Evaluation Report (C.H.E.R.) for the Killarney Wharf property at 21 Channel Street in the Municipality of Killarney, Ontario. The C.H.E.R. is being undertaken as part of the Killarney Wharf Redesign and Reconstruction Project. The property consists of a combined wood and concrete wharf, a wooden finger dock, gravel parking lot, boat launch, and contemporary restaurant building. This report will primarily focus on the wharf and associated dock and boating infrastructure. The wharf does not have any known heritage recognition. The property requires a C.H.E.R. in accordance with the *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes, A Checklist for the Non-Specialist* (Ministry of Citizenship and Multiculturalism, 2022).

This report includes an evaluation of the cultural heritage value of the property as determined by the criteria in Ontario Regulation 9/06 of the *Ontario Heritage Act*. This evaluation determined that the Killarney Wharf has historical and associative value as well as contextual value.

The following recommendations are proposed:

1. Given that the Killarney Wharf was determined to meet the criteria outlined in Ontario Regulation 9/06, meaning that the property retains cultural heritage value or interest, a Heritage Impact Assessment (H.I.A.) of the wharf is required to evaluate the expected impacts to the property. Fieldwork, including photographic documentation of the structure and surroundings, should be carried out as part of the H.I.A. to confirm the existing conditions of the wharf and serve as a record of the wharf prior to its demolition.

2. This C.H.E.R. should be submitted by the proponent to heritage planning staff at the Municipality of Killarney, the Ministry of

Citizenship and Multiculturalism, and any other interested stakeholders for review.

# Report Accessibility Features

This report has been formatted to meet the Information and Communications Standards under the *Accessibility for Ontarians with Disabilities Act*, 2005 (A.O.D.A.). Features of this report which enhance accessibility include: headings, font size and colour, alternative text provided for images, and the use of periods within acronyms. Given this is a technical report, there may be instances where additional accommodation is required in order for readers to access the report's information. If additional accommodation is required, please contact Annie Veilleux, Manager of the Cultural Heritage Division at Archaeological Services Inc., by email at aveilleux@asiheritage.ca or by phone 416-966-1069 ext. 255.

# Project Personnel

- **Senior Project Manager**: Lindsay Graves, M.A., C.A.H.P., Senior Cultural Heritage Specialist, Assistant Manager - Cultural Heritage Division
- **Project Coordinator:** Jessica Bisson, B.F.A. (Hon.), Cultural Heritage Technician, Division Coordinator - Cultural Heritage Division
- **Project Manager**: John Sleath, M.A., Cultural Heritage Specialist, Project Manager - Cultural Heritage Division
- **Report Production**: Michael Wilcox, P.h.D., Historian - Cultural Heritage Division
- **Graphics Production**: Andrew Clish, B.E.S., Senior Archaeologist - Planning Assessment Division
- **Report Reviewer(s)**: John Sleath and Lindsay Graves

For further information on the Qualified Persons involved in this report see Appendix A.

# Glossary

**Built Heritage Resource (B.H.R.)**
Definition: "…a building, structure, monument, installation or any manufactured or constructed part or remnant that contributes to a property's cultural heritage value or interest as identified by a community, including an Indigenous community" (Ministry of Municipal Affairs and Housing, 2024, p. 40).

**Cultural Heritage Landscape (C.H.L.)**
Definition: "…a defined geographical area that may have been modified by human activity and is identified as having cultural heritage value or interest by a community, including an Indigenous community. The area may include features such as buildings, structures, spaces, views, archaeological sites or natural elements that are valued together for their interrelationship, meaning or association"(Ministry of Municipal Affairs and Housing, 2024, p. 41).

**Significant**
Definition: With regard to cultural heritage and archaeology resources, significant means "resources that have been determined to have cultural heritage value or interest. Processes and criteria for determining cultural heritage value or interest are established by the Province under the authority of the *Ontario Heritage Act*" (Ministry of Municipal Affairs and Housing, 2024, p. 52).

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# 1.0 Introduction

Archaeological Services Inc. was contracted by EXP Services Inc. to conduct a Cultural Heritage Evaluation Report (C.H.E.R.) for the Killarney Wharf property at 21 Channel Street in the Municipality of Killarney, Ontario (Figure 1). The C.H.E.R. is being undertaken as part of the Killarney Wharf Redesign and Reconstruction Project. The property consists of a combined wood and concrete wharf, a wooden finger dock, gravel parking lot, boat launch, and contemporary restaurant building. This report will primarily focus on the wharf and associated dock and boating infrastructure. The wharf does not have any known heritage recognition. The property requires a C.H.E.R. in accordance with the *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes, A Checklist for the Non-Specialist* (Ministry of Citizenship and Multiculturalism, 2022). See Appendix C for the completed Checklist.

## 1.1 Project Overview

The Killarney Wharf Redesign and Reconstruction Project has been underway since 2013, when plans for a new building, now Herbert Fisheries, was approved. It was designed by PBK Architects and built by RCI Reasbeck Construction Inc. circa 2014 (PBK Architects, 2013). In 2023, the project was expanded to include the removal of the boathouse from the wharf property at 21 Channel Street. In a June 2023 meeting, the council of the Municipality of Killarney approved the Chief Building Official's Order to Comply to demolish the boathouse as it was a hazard to the public's health and safety (The Corporation of the Municipality of Killarney, 2023). The current project scope entails the removal and replacement of the existing wharf in Killarney Channel to address ongoing flooding and safety concerns. The replacement wharf will continue to support the tourism, recreation, and commercial requirements of the community.

## 1.2 Legislation and Policy Context

Pursuant to the *Environmental Assessment Act* (Ministry of the Environment 1990), applicable infrastructure projects are subject to heritage assessment and/or evaluation to identify built heritage resources and cultural heritage landscapes and to determine related impacts on identified heritage properties (Ministry of Transportation, 2007). Infrastructure projects have the potential to impact built heritage resources and cultural heritage landscapes in a variety of ways such as loss or displacement of resources through removal or demolition and the disruption of resources by introducing physical, visual, audible, or atmospheric elements that are not in keeping with the resources and/or their setting.

The analysis used throughout the cultural heritage evaluation process addresses built heritage resources and cultural heritage landscapes under other various pieces of legislation and their supporting guidelines. These policies form the broad context which frame this assessment, and are included as relevant to this undertaking based on professional opinion and with regard for best practices:

- *Environmental Assessment Act* (Ministry of the Environment, 1990);
- *Provincial Policy Statement* (Ministry of Municipal Affairs and Housing, 2024);
- *Ontario Heritage Act* (Ontario Heritage Act, R.S.O. c. O.18, [as Amended in 2023], 1990); and,
- *Ontario Heritage Tool Kit* (Ministry of Citizenship and Multiculturalism, 2006).

## 1.3 Approach to Cultural Heritage Evaluation Reports

The scope of this C.H.E.R. is guided by the *Ontario Heritage Tool Kit* (Ministry of Citizenship and Multiculturalism, 2006).

Generally, C.H.E.R.s include the following components:

- A general description of the history of the subject property as well as detailed historical summaries of property ownership and building(s) development;
- A description of the cultural heritage landscapes and built heritage resources that are under evaluation in this report;
- Representative photographs of the exterior and interior of a building or structure, and character-defining architectural details;
- A cultural heritage evaluation guided by the *Ontario Heritage Act* criteria;
- A Statement of Cultural Heritage Value and a list of heritage attributes, if applicable;
- Historical mapping, photographs; and
- A location plan.

Using background information and data collected during the site visits, the property is evaluated using criteria contained within Ontario Regulation 9/06. The criteria require a full understanding, given the resources available, of the history, design and associations of all cultural heritage resources of the property. The criteria contained within Ontario Regulation 9/06 requires a consideration of the community context.

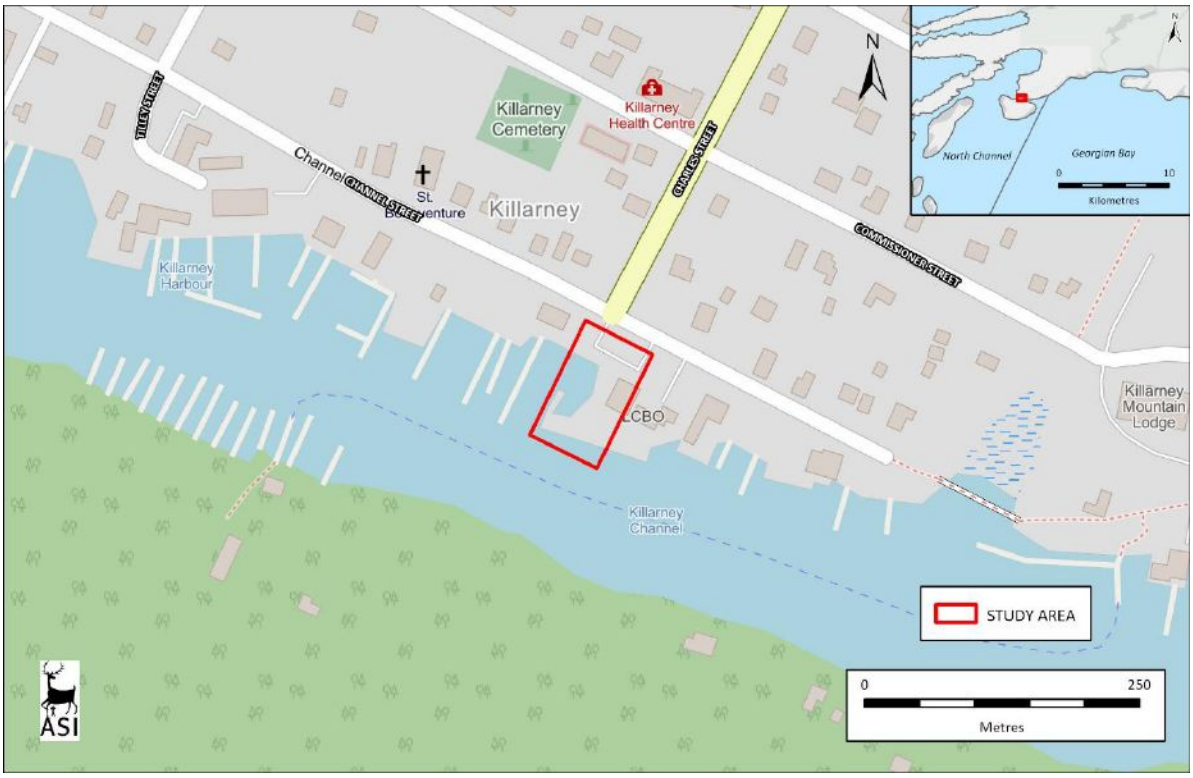



Figure 1: Location of the Killarney Wharf in the Municipality of Killarney. Source: (c) Open Street Map contributors, Creative Commons n.d.

# 2.0 Engagement

The following section outlines the community consultation that was undertaken to gather and review information about the subject property.

## 2.1 Relevant Agencies/Stakeholders Engaged and/or Consulted

The following stakeholders were contacted with inquiries regarding the heritage status and for information concerning the subject property and any additional adjacent built heritage resources or cultural heritage landscapes:

- Candy Beauvais, Clerk-Treasurer, Municipality of Killarney (email communication 30 January 2025). Email correspondence confirmed that the Municipality of Killarney does not have a Heritage Register and that

the Killarney Wharf has not been previously identified as a heritage resource by the municipality.

- The Ministry of Citizenship and Multiculturalism (M.C.M.) (email communication 30 January 2025). Email correspondence confirmed that there are no properties designated by the Minister and no known Provincial Heritage Properties within or adjacent to the study area.
- The Ontario Heritage Trust (O.H.T.) (email communication 30 January 2025). A response indicated that there are no O.H.T. conservation easements, plaques, or Trust-owned properties within the study area. The O.H.T. does have a heritage plaque about the founding of Killarney at the corner of Commissioner and Charles Streets, north of the study area.

## 2.2 Agency Review

The draft report was submitted to the Municipality of Killarney on 3 April 2025 and to the M.C.M. on 25 July 2025 for review and comment. No comments or revisions were suggested following review by either party. The final cultural heritage evaluation report (C.H.E.R.) will be submitted to the Municipality of Killarney and the M.C.M. for their information.

## 2.3 Indigenous Nations Engagement

The following Indigenous Nations were contacted as part of the Environmental Assessment portion of this project: Wikwemkoong First Nation; Whitefish River First Nation; and the Metis Nation of Ontario. No feedback related to the cultural heritage value of the wharf had been received at the time of report finalization.

# 3.0 Description of the Property

The following section provides a description of the subject property.

## 3.1 Existing Conditions

The Killarney Wharf property consists of a combined wood and concrete wharf, a wooden finger dock, gravel parking lot, boat launch, and contemporary restaurant building (Figure 2). The subject property, which is owned by and located within the Municipality of Killarney, is immediately south of Channel Street at the base of Charles Street within Killarney Channel. The subject wharf was erected in 1951. It is a composite structure that employs natural materials like wood and stone alongside pre-cast and cast-in-place reinforced concrete. The main wharf measures 100 feet (30.5 metres) in length on the south elevation and approximately 20 feet (6.1 metres) in width. The west face adjacent to the boat launch is approximately 38 metres long. The wooden finger dock, constructed sometime in the 1950s after the main portion of the wharf, is approximately three metres wide and 25 metres long. George Island is across the channel, approximately 75 metres south of the subject wharf.




Figure 2: Aerial image of the Killarney Wharf at 21 Channel Street, 2022 (Google Maps)

## 3.2 Heritage Recognitions

The Killarney Wharf is not recognized as a known or potential heritage property by the municipal, provincial, or federal government.

## 3.3 Adjacent Lands

No known or potential heritage properties are located adjacent to Killarney Wharf.

# 4.0 Research

This section provides: the results of primary and secondary research; a discussion of historical or associative value; a discussion of physical and design value; a discussion of contextual value; and results of comparative analysis.

## 4.1 List of Key Sources and Site Visit Information

The following section describes the sources consulted and research activities undertaken for this report.

### 4.1.1 Key Sources

Background historical research, which includes consulting primary and secondary source documents, photos, and historic mapping, was undertaken to identify early settlement patterns and broad agents or themes of change in the subject property. In addition, online historical research was undertaken through the websites of the following libraries and archives to build upon information gleaned from other primary and secondary materials:

- Library and Archives Canada
- Archives of Ontario
- The Association of Great Lakes Maritime History
- The Great Lakes Museum

Available federal, provincial, and municipal heritage inventories and databases were also consulted to obtain information about the properties. These included:

- The *Ontario Heritage Act Register* (Ontario Heritage Trust, n.d.b);
- The *Places of Worship Inventory* (Ontario Heritage Trust, n.d.c);
- The inventory of Ontario Heritage Trust easements (Ontario Heritage Trust, n.d.a);
- The Ontario Heritage Trust's *An Inventory of Provincial Plaques Across Ontario*: a PDF of Ontario Heritage Trust Plaques and their locations (Ontario Heritage Trust, 2023);
- Parks Canada's *Directory of Federal Heritage Designations*, an on-line database that identifies National Historic Sites, National Historic Events, National Historic People, Heritage Railway Stations, Federal Heritage Buildings, and Heritage Lighthouses (Parks Canada, n.d.b); and
- Parks Canada's *Historic Places* website, an on-line register that provides information on historic places recognized for their heritage value at all government levels (Parks Canada, n.d.a).

Previous consultant reports associated with known and potential built heritage resources, cultural heritage landscapes, and archaeological resources within and/or adjacent and/or in the vicinity of the subject property in the Municipality of Killarney, Ontario included the following:

- Stage 1 Archaeological Assessment: Killarney Wharf Redesign and Reconstruction, District of Sudbury (Archaeological Services Inc., 2023)

A full list of references consulted can be found in Section 8.0 of this document.

### 4.1.2 Site Visit

A site visit to the subject property was not carried out by staff from Archaeological Services Inc. (A.S.I.) as the channel was frozen and the wharf was covered in snow at the time of draft report preparation (March 2025). As recreational and commercial boating activities cease during the winter months, the Municipality of Killarney also uses the wharf to pile snow removed from

other areas onto the site. The combination of snowfall and redeposited snow largely obscured the subject wharf and large parts of the property in February 2025. However, photographs from July 2020, August 2023, and February 2024 were provided to A.S.I. by EXP Services Inc. which provide recent documentation of the wharf and surrounding property. These photographs, as well as Google Streetview imagery, were used to prepare this C.H.E.R.

## 4.2 Discussion of Historical or Associative Value

Historically, the study area was located in the Village of Killarney within the Township of Rutherford and George Island.

### 4.2.1 Summary of Early Indigenous History along the North Shore of Lake Huron

Current archaeological evidence indicates that northern Ontario was occupied by human populations much later than the south. The Laurentide glacier would have retreated above the study area by approximately 10,500-10,000 before present (B.P.) (Karrow & Warner, 1990, p. Fig 2.9, 2.11). Populations at this time would have been highly mobile, inhabiting a boreal-parkland similar to the modern sub-arctic. By approximately 10,000 B.P., the environment had progressively warmed and populations now occupied less extensive territories (Ellis & Deller, 1990, pp. 62–63). Early populations consisted of highly mobile small bands that were hunting medium and large sized game including caribou, elk, and moose. Fishing was also important, as well as the collection of plant foods such as berries and wild rice, which are underrepresented in the archaeological record due to poor preservation. Tool stone was obtained from primary outcrop deposits such as extensive quartzite deposit at the Sheguiandah site (Brose et al., 2021; Julig, 2002).

Between approximately 10,000-5,500 B.P., the Great Lakes basins experienced low-water levels, and many sites which would have been located on those former shorelines are now submerged (Karrow & Warner, 1990). Approximately 9,000 years ago there is evidence in the Huron basin of submerged stone drive lanes used for hunting caribou during their annual migration (Lemke & O'Shea,

2019). However, by the Middle Archaic period (5,000 B.P.), sites that are directly associated with the Nipissing High Stand beach terraces are situated from up to 30 metres above present lake levels (Julig & Beaton, 2015).

In the boreal forest of northern Ontario this period is referred to as the Shield Archaic (Wright, 1985) and in northeastern Ontario is well represented in the Killarney area by the Killarney and George Lake sites (Stork, 1974) and in the Spanish River drainage basin, where there is a significant Early Archaic occupation (Hanks, 1988). This period produces the earliest evidence of heavy wood working tools, an indication of greater investment of labour in felling trees for fuel, to build shelter, and watercraft production. These activities suggest prolonged seasonal residency at occupation sites. Polished stone and native copper implements were being produced by approximately 8,000 B.P.; the latter was acquired from the north shore of Lake Superior, evidence of extensive exchange networks throughout the Great Lakes region (Brose et al., 2021). The earliest archaeological evidence for cemeteries dates to approximately 4,500-3,000 B.P. and is interpreted by archaeologists as indicative of increased social organization, investment of labour into social infrastructure, and the establishment of socially prescribed territories (Brown, 1995, p. 13; Ellis et al., 1990, 2009).

Between 3,000-2,500 B.P., populations continued to practice residential mobility and to harvest seasonally available resources, including a continued reliance on spawning fish. The Woodland period begins around 2,500 B.P. and exchange and interaction networks broadened at this time (Spence et al., 1990, pp. 136, 138). By approximately 2,000 B.P., evidence exists for small community camps, focusing on the seasonal harvesting of resources (Spence et al., 1990, pp. 155, 164). As is clearly evident in the detailed ethnographies of Anishinaabeg populations, winter was a period during which some families would depart from the larger group as it was easier to sustain smaller populations (Rogers, 1962). It is generally understood that these populations were Algonquian-speakers during these millennia of settlement and land use.

Remains from Laurel-period (2,200–1,200 B.P.) archaeological sites show a strong riverine and lake adaptation. The subsistence strategies during this period involved, like the Archaic period, a wide range of faunal and floral resources, including the harvesting of wild rice. Seasonal gatherings of people for subsistence and social purposes began to occur during this period, resulting in the appearance of large settlements at prime fishing locations. A Middlesex-burial mound occurs in the Killarney area northeast of Georgian Bay (Brose et al., 2021) and later Laurel mounds are known from the Rainy River area of northwestern Ontario, indicating a strongly developed mortuary practice influenced by the Hopewell groups of the Ohio valley. The grave offerings associated with these burials continued to place an emphasis upon the exotic origin of raw materials (Spence et al., 1990). These developments suggest that changes first evidenced in the preceding Early Woodland period continued to develop and be expanded upon.

Before the European arrival, extensive exchange systems had already developed between the Anishinaabe and Cree of north-central and northeastern Ontario and the Huron-Wendat and other Iroquoian groups to the south (Trigger, 1985). The end of the Late Woodland period in northern Ontario is marked by the appearance of European trade goods circa 1600 of the Common Era (C.E.).

At the time of European contact in the early seventeenth century, Anishinaabe bands were located throughout northeastern Ontario. With the help of the Wendat, some of these bands were identified by French explorers and missionaries (Heidenreich, 1990; Steckley, 1990). These include the Nipissing, Outimagami, Timiscimi, Achiligouan, Amikwa, Nikikouet, Mississauga, and Sauteaux. By the late seventeenth century, attacks from the Haudenosaunee (who had defeated the Wendat, Tionontaté, and Attiwandaronk in southern Ontario) dispersed some of these groups. Anishinaabe oral history recounts that counter attacks drove the Haudenosaunee back to their homeland.

In 1701, the Great Peace of Montreal and the Dish with One Spoon Treaties ended hostilities between the Haudenosaunee and Anishinaabe. In the study area, Indigenous peoples continued to pursue their traditional way of life based

on the seasonal pursuit of game, fish, wild plants and the growing of maize and potatoes. The commercial fur trade had a significant impact on the Anishinaabe as an increasing reliance on European trade goods meant that considerable effort was spent trapping and processing pelts. Moreover, more time was spent in close proximity to the fur trade posts established by the Hudson's Bay Company and the Northwest Company. These larger communities became a place of year-round occupation.

The Killarney Wharf is located within the territory covered by the Robinson-Huron Treaty (Treaty 61) of 1850. This treaty includes lands east of Georgian Bay and the northern shore of Lake Huron. In 1850, the Robinson-Huron treaty was signed in Baawating (Sault Ste. Marie) by the Lake Huron Chiefs and leaders of the Anishinaabeg signatory First Nations ceding the Lake Huron shoreline, including the islands, from Matchedash Bay to Batchewana Bay, and inland as far as the height of land, for resource extraction and settlement (Surtees, 1986). One of the signatories was Anishinaabe Chief Shingwaukonse (Little Pine) (1773-1854), a veteran of the War of 1812 who had helped establish Garden River First Nation. While the settlement was restricted to the established reserves, "the full and free privilege to hunt over the territory [then] ceded by them and to fish in the waters thereof as they have heretofore been in the habit of doing" was retained in the Treaty for the first time in treaty-making history, as well as cash payment for annuities (Surtees, 1971, 1986).

### 4.2.2 Algoma District and Manitoulin District

The study area was located within Algoma District from 1858 to 1888 and within Manitoulin District from 1888 to 1999.

Following the 1850 Robinson Treaty, subsequent government jurisdiction and infrastructure expanded in northern Ontario, allowing for an increase in settler population. The initial survey of the Algoma District commenced in the 1850s and the district administration officially commenced in 1858 (Gentilcore & Head, 1983, p. 106). The area was surveyed using the United States section survey method, resulting in townships that were 36 miles square, which were further

divided into sections of one square mile each. At the time of its initial survey, the Algoma District was relatively isolated since rail lines and roads had yet to be established. In 1869, the Algoma District underwent the first of many boundary revisions when it was temporarily divided into the West (First) and East (Second) Algoma Districts. In 1871, the size of the Algoma District was reduced with the creation of the District of Thunder Bay (Ministry of Government and Consumer Services, 2011). Algoma District continued to shrink with the creation of Manitoulin District in 1888, Sudbury District in 1894, and Timiskaming District in 1912. The Canadian Pacific Railway reached the Algoma District in 1883, which opened the area to further settlement and the establishment of the logging industry (Andreae, 1997).

The study area was located within the Manitoulin District from 1888 until 1999. The district, located in the northern part of Lake Huron, formerly included Manitoulin Island and many of its surrounding islands as well as other unorganized lands on the mainland, and, until 1999, the Township of Rutherford and George Island, where Killarney – its principal village – was located. On 1 January 1999, the Township of Rutherford and George Island amalgamated with several unorganized townships to become the Municipality of Killarney (Municipality of Killarney, 2022). At this time, the new Municipality of Killarney was transferred from the District of Manitoulin to the Sudbury District.

### 4.2.3 Killarney Village

Historically, the property was located in Killarney Village, which had originally been a location for voyageurs to shelter during their trips between Montreal and Fort William (Thunder Bay) (Hind, 2014; McCulloch, 2005). Before the first Euro-Canadian settlers arrived, the channel in front of what became the community was called Shebahonaning, which means safe canoe passage or channel in Ojibwa (Hind, 2014; Shebahonaning Anishinabek, n.d.). In 1820, the community was officially founded as a fur trading post by Etienne Augustin de la Morandiere (1767-1859). He was a French-Canadian fur trader, who married Josephte/Josette Sai Sai Go No Kwe in 1800. Members of the de la Morandiere family “felled the trees, built a home and outbuildings, planted crops, brought in

cattle, and founded a dynasty in the first permanent white village on the shores of the North Channel and Georgian Bay" (Brazer, 1987). Many of the earliest settlers were French-Canadian fishermen (Roy, 1905). The village became an important stopping point on a main route of travel for explorers, mining and logging companies, government officials, business operators, and settlers (Municipality of Killarney, 2015).

A post office was founded circa 1855. Thereafter, the population grew, a result of the expansion of both the logging and fishing industries. Fishing came to overtake logging as the principal industry in the community in the late nineteenth century; by 1886, one writer commented that Killarney was a "fishing village of much fish importance" (Barlow, 1886). Killarney Village was "one of the most productive of Georgian Bay's many fishing ports" between the 1870s and 1950s (Hind, 2014). Among the many fishing companies were those belonging to Charles William Low, the Nobles, Charles Low/Joseph Roque partnership, and Albert Lowe. Killarney was formerly a bustling commercial fishing village; fishing employed over 100 people in the early twentieth century (Barry, 1995; McCullough, 1989). However, overfishing, technological advancements in the industry, and the arrival of non-native species were significant contributors to fishing industry's decline in the second half of the twentieth century (Hind, 2014; McCulloch, 2005). With the completion of Highway 637 in the early 1960s, a development that facilitated transportation into and out of the community, and the opening of Killarney Provincial Park in 1964, tourism gradually replaced fishing as the primary industry in the community. The town has served as a base for the park, as well as for various lodges and inns (Hind, 2014; McCulloch, 2005). In 1999, the Township of Rutherford and George Island was replaced and expanded by the Municipality of Killarney; at the same time, the municipality fell under a new district administration, moving from the Manitoulin District to the Sudbury District.

### 4.2.4 Killarney Channel

The study area includes the Killarney Channel, which is located along the north shore of Georgian Bay, and which separates George Island from the village of

Killarney. Whether by canoes, sailing skiffs, yachts, or steamships, Killarney Channel provides a protected route from Georgian Bay's strong winds into the community of Killarney. Travel by water, including with the help of icebreakers in the winter, was the primary means to access the community until a road was built to the town in 1962 (Barry, 1995). Several steamers, tugboats, and other vessels operated between Killarney and Manitoulin Island, including but not limited to the *Waubuno* in the 1860s, the *Silver Spray* and the *Manitoulin* in the 1870s, and the *A.J. Lowe*, the *M.J. Low*, and the *Marschal Foch II* in the 1920s. The channel is still actively used by tourists and fishing enthusiasts in all forms of boats, including tall ships, kayaks, canoes, motorboats, and yachts, with many travelling from the United States. The channel, which is approximately 100 metres wide, has a lighthouse along its north shore at its eastern entrance, and Killarney Harbour is located at its western entrance (Friends of Killarney Park, 1998). Homes, cottages, docks, wharves, and businesses have been located along both sides of the channel for generations, and the channel has been widely depicted in photographs and paintings. See Figure 3 to Figure 6 for several examples of these images.



Figure 3: Killarney Channel and community, 1883 (*Killarney, Ontario*, 1883)

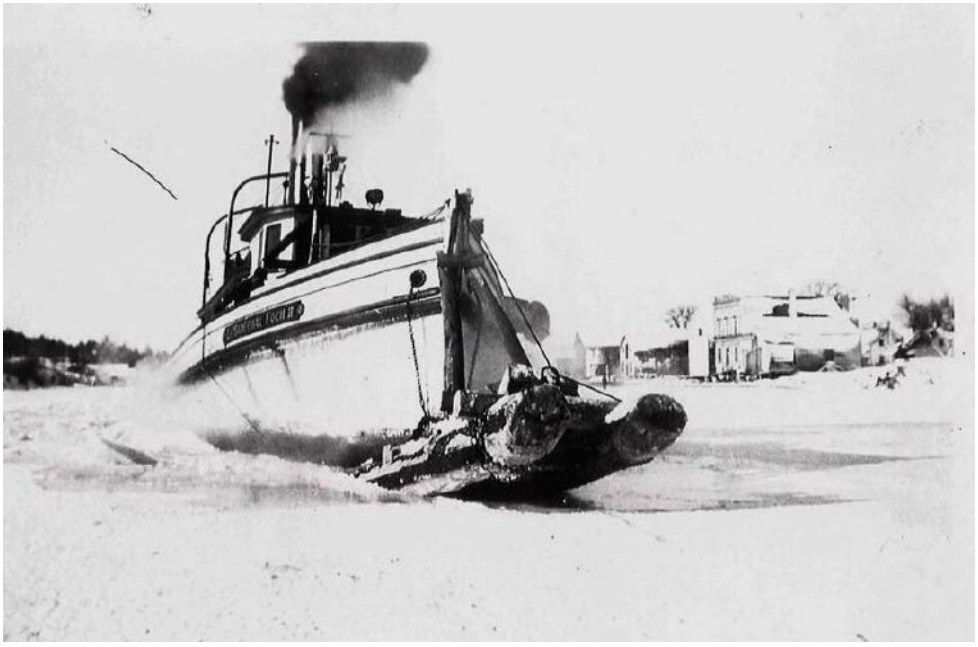


Figure 4: A Killarney Icebreaker, the Marshall Foch II, in the Killarney Channel, circa 1930 (Manitoulin History Facebook page)



Figure 5: Eastern entrance into Killarney Channel (Derry, 2008)



Figure 6: Killarney Channel at Sunset (Derry, 2008)

### 4.2.5 Historical Chronology and Setting of the Subject Property

The following provides a brief overview of the historical chronology of the subject property. It includes a history of the people who lived on or owned the property, as provided in available sources, as well as a mapping review. It is based on a variety of primary and secondary source materials, including maps, abstract indexes, archival images, and historic photographs.

The north shore of the Killarney Channel, including the subject property, has been the site of significant activity since the community was founded in 1820. Since so many of the earliest settlers were fishermen, they likely used the area as both a departure and return point for their fishing excursions in Georgian Bay, while coureurs-de-bois plausibly stopped along the north shore of the channel to trade furs with locals. Depictions of the area from the mid-to-late

nineteenth century show several structures, docks, and fishing boats along the shoreline (Figure 7 and Figure 8).



Figure 7: *Killarney ou Shebahonaning, rive nord du lac Huron, 1853* (Caddy, 1853)



Figure 8: Killarney Channel, 1873 (Johnson, 1873)

While there was certainly plenty of activity within or surrounding what is now the Killarney Wharf, the crown patent for Lot 7 on the south side of Channel Street was only officially allocated to Charles De La Morandiere, the son of the founder of Killarney, in April 1872 (O.L.R.A., n.d.). The 1874 and 1887 maps (Figure 9 and Figure 10) depict the small community of Killarney Village on the north shore of the Killarney Channel, within the Township of Rutherford.

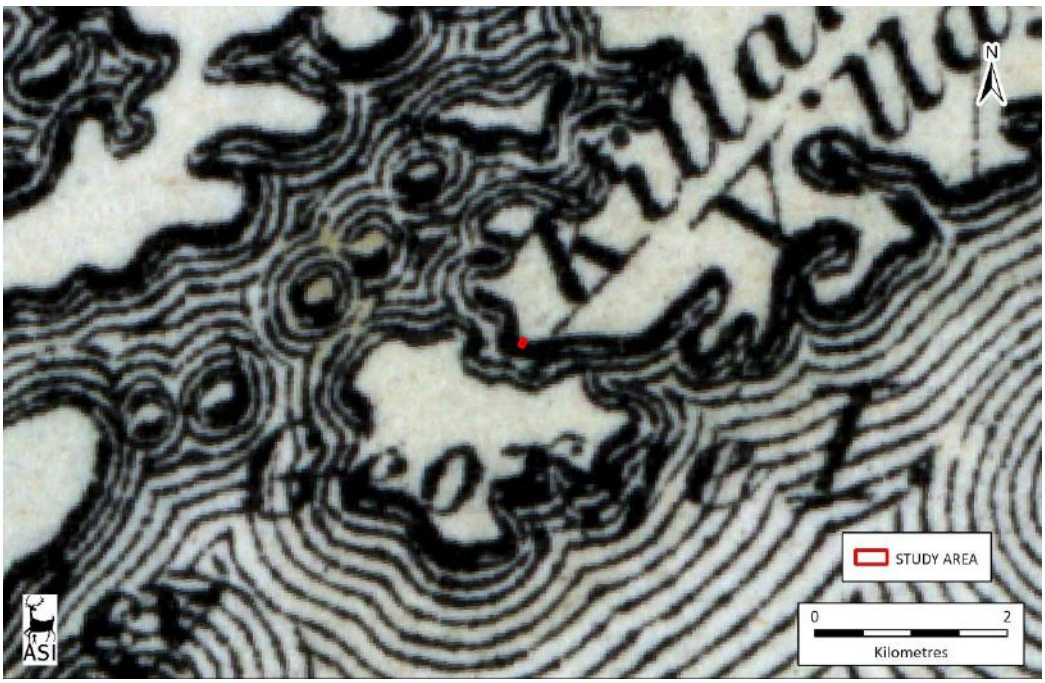



Figure 9: The location of the subject property overlaid on the 1874 Map of the Eastern Part of Algoma (Crown Land Department, 1874)

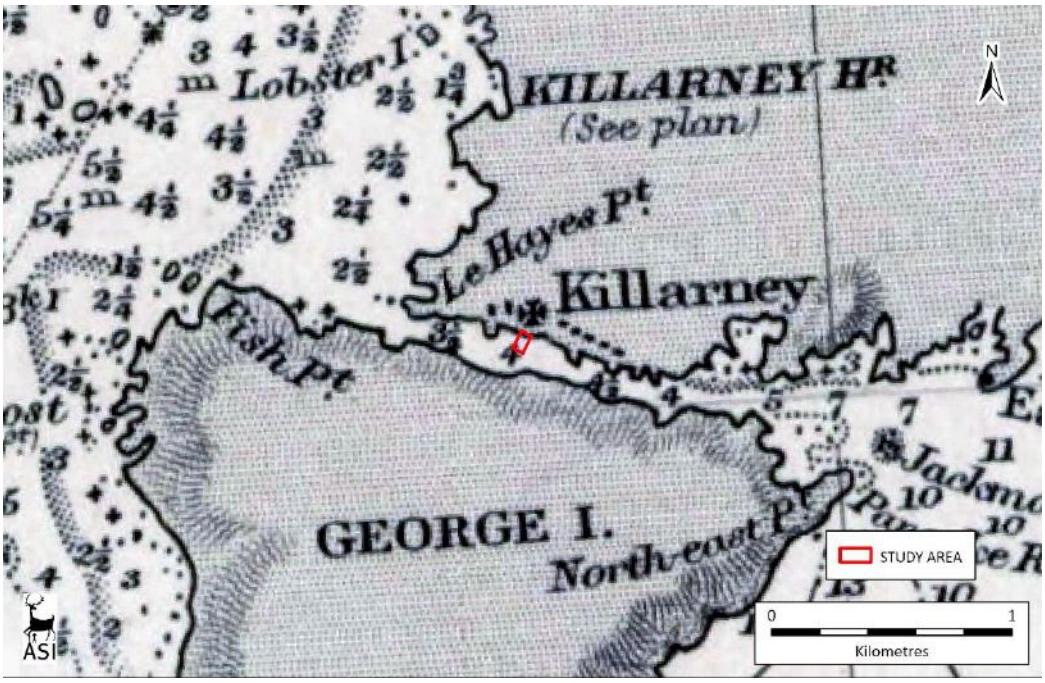



Figure 10: The location of the subject property overlaid on the 1887 Killarney Harbour map (Boulton, 1887)

De La Morandiere sold the property to Lewis Smith for $50 in April 1878, but Smith immediately sold it to brothers James and Charles Noble for $800 (O.L.R.A., n.d.). They remained the property owners for decades thereafter. The Noble Brothers were a large firm in the context of the Great Lakes fishery in the 1880s, meaning that they bought fish from and organized the licences for local fishermen, while also taking care of the packing and shipping (McCullough, 1989). Between 1905 and 1908, James Noble was one of the three commissioners on the Georgian Bay Fisheries Commission, and published the *Report and Recommendations of the Dominion Fisheries Commission* (Georgian Bay Fisheries Commission, 1908).

At some point around the turn of the twentieth century, the Noble Brothers became a constituent company within the larger A. Booth and Company trust, generally known as simply the "Fish Trust" (Georgian Bay Fisheries Commission, 1908). A. Booth and Company was established in Chicago in 1848 as a small fish dealership. They expanded over the second half of the nineteenth century to become a massive organization in both Canada and the United States. Their aim

was to control the supply and sale of fresh water fish in both countries. To that end, they acquired 43 other fishing companies when they organized in 1898, and "controlled 80 per cent of freshwater fish dealers and 150 million pounds of fish annually" (Georgian Bay Fisheries Commission, 1908; McCullough, 1989).

James and Charles Noble officially sold the property to their business, Noble Bros. Co. Ltd., in 1896. In August 1899, the Noble Bros. Co. Ltd. sold the property to William Robinson and his wife, but the following month, the Robinsons sold it (and other lands) to the Dominion Fish Co. Ltd. (O.L.R.A., n.d.). The Dominion Fish Co. Ltd. was the Canadian subsidiary company of the A. Booth and Company, and at this time, the Noble Brothers were among its local agents (McCullough, 1989). As an American-owned company, A. Booth and Company could not hold Canadian fishing licences; as such, they established the Dominion Fish Company to legally hold licences to catch and distribute fish.

The 1905 Fire Insurance Plan (Figure 11) shows the study area south of Channel Street and St. Charles Street, on a wharf – called a fish dock at this time – on the Killarney Channel. The wharf's configuration was slightly different to what it is now; at this time, a laneway led south from Channel Street past an oil house and ended at a shop and post office. Also on the property was a net shed, freight shed, fish warehouse, icehouse, bake house, a storage building, and two unlabelled buildings. Also at this time, the channel provided access to a variety of boats, including a steamboat that travelled between Manitoulin Island and Killarney (Figure 12).

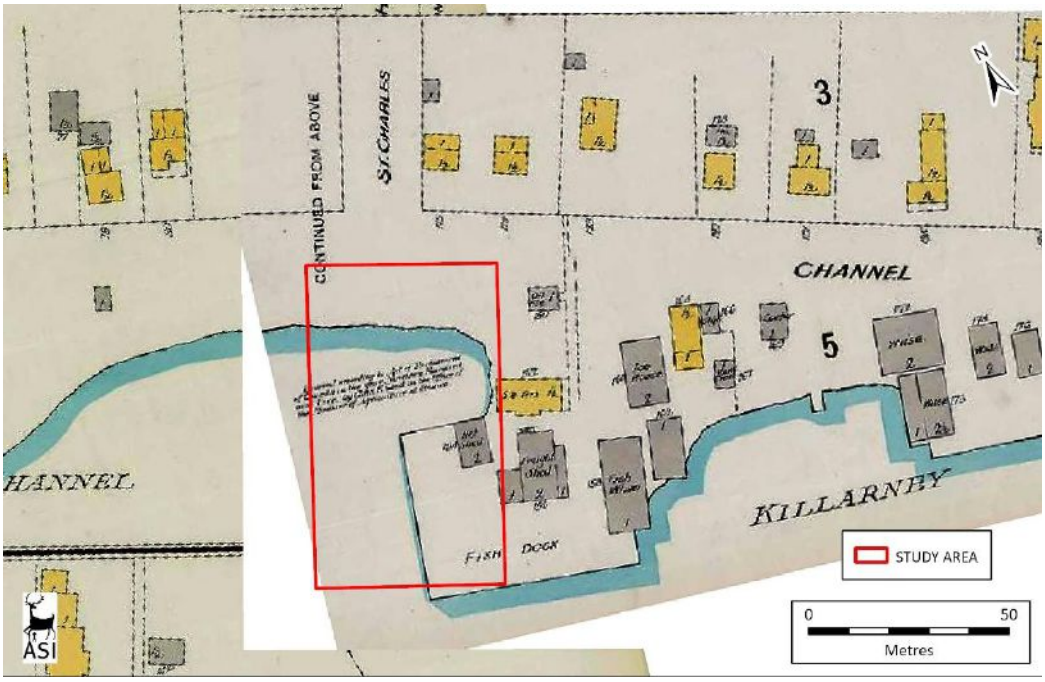



Figure 11: The location of the subject property overlaid on the 1905 Fire Insurance Plan of Killarney (Goad, 1905)

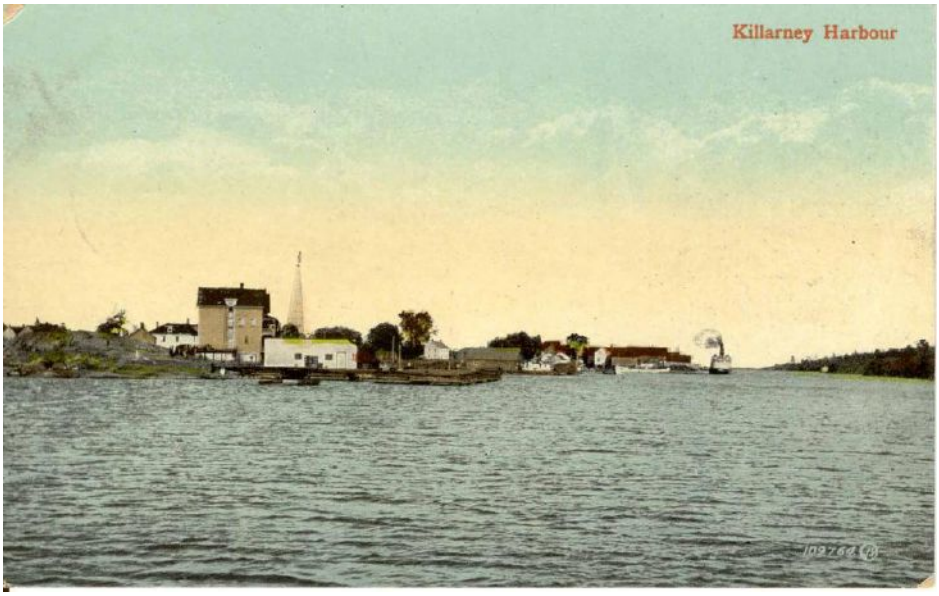



Figure 12: Coloured postcard of a steamboat entering the harbour at Killarney, Ontario, on Georgian Bay, c. 1907 (Valentine and Sons Publishing Co. Ltd, 1907)

In the wake of economic problems, the Dominion Fish Co. Ltd. divided the property into two lots (one portion on the water and one portion on the land) in

1920 and sold both parts to Booth Fisheries Canadian Co. Ltd., a new Canadian subsidiary of the larger A. Booth and Company. Booth Fisheries Canadian Co. Ltd. established a strong hold on the fishery industry in the upper Great Lakes (McCullough, 1989).

Between the 1920s and 1940s, the wharf and its surrounding area appears to have been a very active location for local fishermen and tourists, many of whom stayed at the Killarney Hotel (Figure 13).



Figure 13: Killarney Channel and wharf, circa 1920, with hotel at far left (Manitoulin History Facebook page)

Booth Fisheries Canadian Co. Ltd sold the land-based part of the lot to John Lowe in 1947, and he then transferred that same portion to the crown for $1,200 in 1951 (O.L.R.A., n.d.). The following year, Order-in-Council 2484/50 marked the registration date for the official transfer of the water-based part of the lot to the crown (Briggs, 1985). In 1951, the Public Works of Canada initiated Plan No. 3467: the Wharf and Warehouse Plan and Details for the wharf site in Killarney (Public Works of Canada, 1951), which is available as Appendix B at the end of this report. With this plan, a new frame warehouse measuring 50 feet long and 22 feet wide was erected and the wharf was rebuilt. Changes to the wharf included replacing the existing round-timber stone filled cribs with new cribs built of 10 x 10-inch squared timbers. These stone filled wooden cribs were

tied together with both wooden and cast-in-place concrete beams to support the wharf deck which included pre-cast concrete blocks and cast-in-place reinforced concrete. Wooden fenders were added to the exterior faces of the wharf to prevent damage to boats docking at the structure (Figure 14). No wooden finger dock is depicted in the 1951 drawings (Appendix B); however, they are depicted in the circa 1960s aerial photograph (Figure 15), indicating its construction in the 1950s.

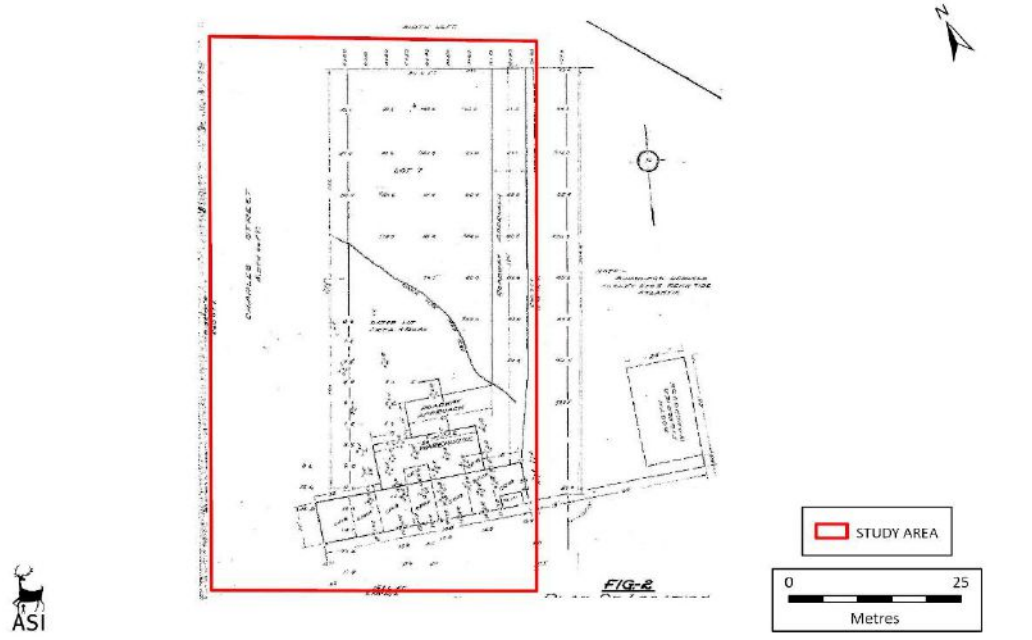



Figure 14: The location of the subject property overlaid on the 1951 Plan of Public Works (Public Works of Canada, 1951)

Around this same time, the net/twine shed formerly on the property was moved east to the Low family property; a fishermen's co-op packing house was begun at the site of what is now the liquor store; and a one-storey frame boathouse at the southeast corner of the wharf was erected, though it was removed in 2023 (Unknown, 1985a). The new warehouse and wharf are depicted in a circa 1960s aerial photograph (Figure 15).



Figure 15: Killarney Channel, showing Killarney Wharf, circa 1960s (Manitoulin History Facebook page)

By the 1980s, the wharf property included a concrete boat launching ramp in the northwest corner and a one-storey frame building with a wooden deck facing onto Channel Street. This building may have been built in 1952 and was converted to a fish market in the 1980s (Brazer, 1987; Unknown, 1985b). The property also had a gravel driveway and parking lot through most of the interior, a one-storey frame building (used as wine shed and storage) with an "Old Bus (Chip Stand)" in front, a one-storey frame boathouse in the southeast corner, and a concrete dock along the south part of the wharf, a wooden dock in the southwest corner, and a wooden dock pathway along the west side of the wharf separating the parking lot from the water and connecting the launching ramp with the wooden dock (Briggs, 1985; Unknown, 1985b) (Figure 16).

The old bus mentioned above was the original location of Herbert Fisheries, which was started by Ross Herbert in the 1980s. After approximately 40 years, he has "become a Killarney fixture" (Hind, 2014) and his restaurant is now located in a two-storey building on the wharf property, erected sometime

between 2013 and 2018. A photograph of the bus and frame building are pictured in an undated photo below (Figure 17).




Figure 16: The location of the subject property overlaid on a 1985 Plan of Survey map (Briggs, 1985)




Figure 17: Fish and Chips shop operating out of an old bus, with one-storey frame building in behind (Manitoulin History Facebook page)

By the late 1980s, the study area – called the "Government Wharf" at this time – was described as being "of the usual sturdy type with no services" (Brazer, 1987). A boat for ferrying workers and supplies to the nearby silica quarry used the wharf regularly; the launching ramp was located here; a beach was available for swimmers "at the inner end"; and "several wood docks" for boat parking were available (Brazer, 1987). In 1999, the crown transferred both parts of the lot to the Municipality of Killarney (O.L.R.A., n.d.).

### 4.2.6 Wharf Engineer

The Killarney Wharf was erected by the Public Works of Canada in 1951. According to the design drawings in Appendix B, the survey was done by "D.R.L." the drawings were traced and drawn by "J.A.U." The work was then checked by "T.M.M." and "L.H.B." before final approval by the Chief Engineer, whose name is illegible in the drawings (Figure 40 to Figure 42). In mid-twentieth century Canada, the Public Works of Canada planned and carried out a variety of infrastructure projects across the country, including the construction,

maintenance, and repair of wharves, dams, bridges, hydraulic works, harbours, piers, and drydocks as well as highways, public and government buildings, telegraph lines, and airports (Government of Canada, 1953).

## 4.3 Discussion of Physical and Design Value

The following discusses the physical and design value of the subject property. Heavy snowfall and the presence of large snow piles on site removed from other areas in the municipality during the winter of 2024/2025 prevented a field review during completion of this draft report. Note that all photographs were taken in August 2023 except for Figure 27, which was taken in July 2020, and Figure 32, which was taken in February 2024. All photos were provided to A.S.I. by EXP Services Inc. during report preparation.

### 4.3.1 Physical Characteristics

The Killarney Wharf features a gravel driveway and parking lot at the north end of the property, as well as a boat launch with access off Channel Street. The west side of the property (southwest of the gravel parking lot and west and southwest of the restaurant building) features a wooden dock to provide public access to and from parked boats. The wooden dock continues to the southwest corner of the property, where it then extends northward to provide another area for boat parking and to create a safe entry point into the harboured area along the west side of the wharf. This southwest corner and extension have picnic tables set up thereon for public use and are labelled in the design drawings as a finger dock resting on stone filled wooden cribs. The main portion of the wharf is concrete with wooden fenders along the south boundary of the wharf, with boat parking available along its wall. The restaurant structure is located on the east side of the lot, approximately halfway between Channel Street and the Killarney Channel (Figure 18 to Figure 32).

The subject wharf is a composite structure that employs natural materials like wood and stone alongside pre-cast and cast-in-place reinforced concrete. The main wharf is integrated into the shoreline, and measures 100 feet (30.5 metres) in length on the south elevation and at least 20 feet (6.1 metres) in

width according to the 1951 design drawings in Appendix B, while the west face adjacent to the boat launch is approximately 38 metres long. The wooden finger dock, constructed sometime in the 1950s after the main portion of the wharf, is approximately three metres wide and 25 metres long.

The substructure of the wharf features four stone-filled timber cribs, with each measuring 16 feet (4.9 metres) by 20 feet (6.1 metres). The timbers are 10 x 10 inches, attached in an interlocking pattern with spikes. The cribs rest on the channel bottom and are between 10 feet 7 inches (3.2 metres) and 16 feet (4.9 metres) below the water level measured in 1951. These timber cribs are evenly spaced 12 feet (3.7 metres) apart and tied together with a combination of wooden beams and reinforced concrete beams. These cribs and beams support the deck of the wharf, which features pre-cast reinforced concrete blocks resting on the cribs and beams. On top of the pre-cast concrete blocks, cast-in-place reinforced concrete was added. Wooden fenders were added to the faces of the wharf to prevent damage to boats mooring on the structure. The east face of the wharf, between the boat launch and the finger dock, also features wooden dock that acts both as a walkway and mooring for boats. The western portion of the wharf adjacent to the boat launch features a modular concrete block retaining wall, and the base of the boat ramp is cast-in-place concrete.

### 4.3.2 Wharf Evolution and Alterations

Earlier versions of a wharf at the location of what is now the Killarney Wharf on Channel Street at the foot of Charles Street likely began by the mid-nineteenth century. By the early twentieth century, the wharf – then called the Fish Dock – featured an oil house, a shop, a post office, a net shed, freight shed, fish warehouse, icehouse, bake house, a storage building, and two other unknown buildings. Several of these buildings must have been demolished or moved in the first half of the twentieth century. By 1951, new cribs and concrete blocks helped to support a new wharf built by the Public Works of Canada. Plus, a new one-storey frame warehouse and one-storey frame boathouse were erected around this same time. Plus, while not definitively known, it is assumed that the boat launch and another one-storey frame building adjacent to Channel Street

were constructed at this time as well. On the property adjacent to the wharf (where the L.C.B.O. building is now located), a fishermen's co-op packing house was erected. A chip stand was established on the wharf in the 1980s, operating out of an old bus. This chip stand was removed in the 2000s and replaced with a two-storey restaurant building on the property between 2013 and 2018. The fish house on the west side of the wharf was demolished in 2023 due to its unsafe structural condition, with wooden decking installed in its former location.

### 4.3.3 Material and Construction Methods

To construct the existing wharf, the previous wharf elements were removed. 1951 design drawings (Appendix B) indicate that the earlier stone filled cribs with round timbers were removed, though they do not indicate the size or arrangement of the cribs or of the earlier wharf as a whole. However, the former wharf is suspected to have been a similar size based on a review of historical images.

The existing timber cribs would likely have been constructed on dry land by alternating the timbers and attaching with spikes. The cribs would have then been lowered into place on the bottom of the channel, presumably with cranes, with the stone fill added to ensure the wooden structures did not float or shift out of place. Once the cribs were installed, the pre-cast concrete blocks would have been assembled, and the wood and reinforced concrete beams tying the cribs together would have been installed. Following this, reinforcing steel would have been laid and the cast-in-place reinforced concrete deck surface would have been poured. Structures like the boat house and warehouse would have been built on the surface of the newly constructed wharf, and elements like bollards and fenders would have been installed to enable boat mooring.

The wooden finger dock, constructed after the main wharf in the 1950s as it is not included in the 1951 design drawings, would have been constructed in a similar manner with the stone-filled timber cribs installed first and wooden beams and decking installed on top.

### 4.3.4 Existing Conditions Photographs



Figure 18: Looking southeast to wharf property from intersection of Channel and Charles Streets (2023)



Figure 19: Looking east to wharf property from west of boat launch (2023)



Figure 20: Boat launch next to gravel parking area, looking south (2023)



Figure 21: Wood dock pathway adjacent to boat launch, looking northwest (2023)



Figure 22: Wood dock pathway, looking northwest (2023)



Figure 23: Wood dock pathway, looking south (2023)



Figure 24: Parked boats at the wharf, with restaurant at rear, looking east (2023)



Figure 25: Southwest corner of the wharf, looking southwest (2023)



Figure 26: Wooden finger dock resting on wooden cribs from southwest corner of wharf, looking west (2023)

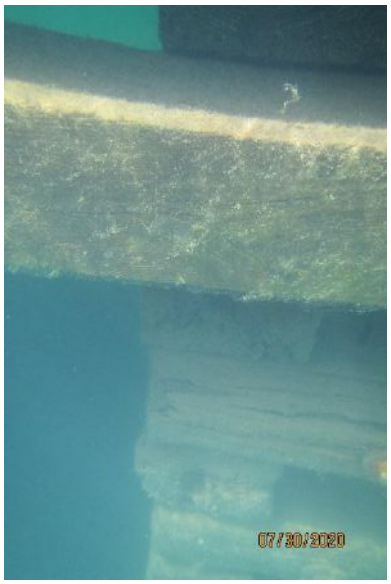



Figure 27: Underwater view of the crib of the finger dock (2020)



Figure 28: Looking west along south boundary of the wharf (2023)



Figure 29: Looking east along south boundary of the wharf, with restaurant at left (2023)[1]

[1] Note that the boathouse at the southeast corner of the wharf, pictured here with a red roof and white siding, was removed later in 2023.



Figure 30: Flat gravel area south of restaurant building, looking northeast (2023)



Figure 31: Former boat house at southeast corner of the wharf property, looking south (2023). This structure was removed later in 2023.



Figure 32: New dock at location of former boat house at southeast corner of the wharf property, looking south (2024)

## 4.4 Discussion of Contextual Value

The following section discusses the contextual value of the subject property.

### 4.4.1 Setting and Character of the Property and Surroundings

The area surrounding the Killarney Wharf is a mix of recreational, commercial, and residential properties. To the north is Channel Street, which has an east-west orientation that roughly parallels the Killarney Channel and features vacant lots and residential properties in the vicinity of the wharf. To the east is the Liquor Control Board of Ontario (L.C.B.O.) building and gravel parking lot. To the west is the Channel Marina, featuring a building with retail, office, and storage space; a dock system; and boat storage area. To the south is the Killarney Channel, which separates the village of Killarney from George Island. The opposite side of the channel features cottages and boat houses on rocky terrain with a diverse mix of trees (Figure 33 to Figure 36).

The Killarney Wharf is historically, contextually, and physically associated with its surrounding environment. The character of this area is scenic, set along the bustling village waterfront. The subject property contributes significantly to this character, which has been at the forefront of life in the community for more than 200 years.



Figure 33: Vacant lot and residential property on north side of Channel Street, across from the Killarney Wharf, looking northeast (Google Streetview, 2024)



Figure 34: L.C.B.O. store and gravel parking lot east of the Killarney Wharf, looking south (Google Streetview, 2024)



Figure 35: Channel Marina building and dock system west of the Killarney Wharf, looking southwest (Google Streetview, 2024)



Figure 36: Killarney Channel, looking west from concrete dock (2024)

### 4.4.2 Community Landmark

The Killarney Wharf at 21 Channel Street is considered to be a landmark within the local context. The site has been in use as a wharf since at least the mid-nineteenth century, and as such, has been the site of significant commercial and recreational activity, and served as the transportation hub of the village prior to the construction of Highway 637 in 1962. The wharf has been, and remains,

widely used by tourists. Furthermore, the restaurant on the property is popular with locals and is a tourist destination for travellers.

## 4.5 Comparative Analysis

An analysis of municipal wharves in other waterfront villages on Georgian Bay and the North Channel was conducted to identify comparable wharf properties for the purposes of establishing a comparative context for evaluating the Killarney Wharf. While many wharves are located on Georgian Bay's eastern and northern shores, the shoreline of Manitoulin Island, and along the northern shore of the North Channel, only three have been chosen for comparative purposes.

### 4.5.1 Municipal Marina, Spanish

The Municipal Marina (Figure 37) is located in the Town of Spanish. The marina features 125 slips (within five piers) for boats of various sizes; a double launch concrete ramp; a service bay; and gravel parking areas, all protected by breakwaters (Town of Spanish, 2025). The docks and boardwalk appear to be made of wood.



Figure 37: Municipal Marina from a lookout spot (Google Maps, 2024)

### 4.5.2 Spider Bay Marina, Little Current

Spider Bay Marina (Figure 38) is located in the community of Little Current within the Town of Northeastern Manitoulin & The Islands (Town of N.E.M.I.). The marina features 130 slips for boats of various sizes; a boat launch; a tourist information centre; washroom facilities; and boat storage areas (Town of N.E.M.I., 2025). The docks appear to be primarily made of wood, though the main wharf, east of the main tourist information centre, may be made of concrete.




Figure 38: Spider Bay Marina and boat launch (Google Streetview, 2014)

### 4.5.3 Bay Street Marina, Manitowaning

The Bay Street Marina (Figure 39) is located in the community of Manitowaning in the Township of Assiginack. The marina features a concrete boat launch; boat slips; a boat servicing area; washroom facilities; and picnic areas and a beach. The docks and boardwalk appear to be made of wood.



Figure 39: Bay Street Marina and boat launch (Google Streetview, 2014)

### 4.5.4 Summary

The three comparative examples present typical materials (i.e., wood, metal, and concrete), services (i.e., boat launch and mooring), and types of structures (i.e., boardwalk and dock) in waterfront towns in the area along the north shore of the North Channel, along the south shore of the North Channel on Manitoulin Island, and along the north shore of Georgian Bay. While the exact date of construction of these comparative wharves is unknown, each is believed to have been constructed when the settlements were founded, albeit with continuing repairs and refurbishments to each. As the harsh marine environment leads to rapid decay of wood and rusting of metal, wharves and associated infrastructure would be regularly repaired as elements deteriorated, and as such, represent evolved waterfront structures. Further, each of these comparative wharves are believed to be landmarks within their respective communities, as they would represent a hub for commerce, tourism, recreation, and transportation in each of the small waterfront communities. As such, Killarney Wharf is not a rare, unique, or old example in this context, as many examples of wharves are found in similar small waterfront communities on Georgian Bay.

# 5.0 Heritage Evaluation

The evaluation of the Killarney Wharf at 21 Channel Street using the criteria set out in Ontario Regulation 9/06 is presented in the following section. The following evaluation has been prepared in consideration of data regarding the

design, historical/associative, and contextual values in the Municipality of Killarney.

## 5.1 Ontario Regulation 9/06

Evaluation of the Killarney Wharf using Ontario Regulation 9/06 of the *Ontario Heritage Act.*

1. The property has design value or physical value because it is a rare, unique, representative or early example of a style, type, expression, material or construction method:
   - The subject property does not meet this criterion.
   - The Killarney Wharf, constructed in 1951, is a mid-twentieth century wharf structure erected on the Killarney Channel shoreline, which is itself along the north shore of Georgian Bay on Lake Huron. Its construction materials, including concrete and wood, as well as its method of construction, is typical of other wharves along the Canadian shoreline of Lake Huron. Moreover, it is not a rare or unique style, type, or expression of a wharf structure, since all wharves serve a utilitarian function.

2. The property has design value or physical value because it displays a high degree of craftsmanship or artistic merit:
   - The subject property does not meet this criterion.
   - The construction of the Killarney Wharf is typical of its period of construction and there is no evidence that the workmanship and artistry of its creation exceeds the standards of this era.

3. The property has design value or physical value because it demonstrates a high degree of technical or scientific achievement:
   - The subject property does not meet this criterion.
   - The Killarney Wharf does not retain any elements or features that exhibit a high degree of technical or scientific achievement.

4. The property has historical value or associative value because it has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community:
   - The subject property meets this criterion.
   - The location and various iterations of the wharf at this location has a direct association with the theme of commerce and with the activity of fishing. The wharf site has been busy from the arrival and settlement of fishermen in the community in the early nineteenth century through to the present. Historically, fishermen departed from and returned to this location and fish was packaged and shipped from this location; more recently, the wharf had a fish market thereon, and tourists have flocked to the site to purchase food from the restaurant on site. The site of what is now the Killarney Wharf also has a direct association with the people and organizations that have been significant to the community. Brothers James and Charles Noble were the wharf owners at this location for decades in the late nineteenth and early twentieth century. Whether with the Noble Brothers Co. Ltd. or the Dominion Fish Co. Ltd., they bought fish from local fishermen, organized fishing licences, and handled packing and distribution. These companies were subsidiaries of the larger A. Booth and Company trust, commonly known as the "Fish Trust".

5. The property has historical value or associative value because it yields, or has the potential to yield, information that contributes to an understanding of a community or culture:
   - The subject property does not meet this criterion.
   - The Killarney Wharf is not known to yield, nor have the potential to yield, information that contributes to an understanding of a community or culture.

6. The property has historical value or associative value because it demonstrates or reflects the work or ideas of an architect, artist, builder, designer or theorist who is significant to a community:
   - The subject property does not meet this criterion.
   - The Killarney Wharf was designed and erected by engineers working for the Public Works of Canada. These Public Works engineers were not significant to Killarney.

7. The property has contextual value because it is important in defining, maintaining or supporting the character of an area:
   - The subject property meets this criterion.
   - The Killarney Wharf is located on the south side of Channel Street on the Killarney Channel. It supports and makes a significant contribution to the area's commercial identity, transportation services, and waterfront tourism industry. As a publicly accessible dockage with boat launch, the wharf continues to be used by visiting boaters to visit the village, and as such, supports the character of the waterfront community.

8. The property has contextual value because it is physically, functionally, visually or historically linked to its surroundings:
   - The subject property meets this criterion.
   - The Killarney Wharf is functionally and historically linked to its surroundings because the wharf, much like the buildings and lots in its vicinity, have historically been associated with water-based transportation and recreational activities such as fishing and boating, as well as tourism.

9. The property has contextual value because it is a landmark:
   - The subject property meets this criterion.
   - The Killarney Wharf has been the site of a wharf since at least the mid-nineteenth century. As such, it has been the site of significant commercial activity to the community, many of

whom relied on fishing for their livelihoods. Until the early 1960s, the wharf site was the only access point to the village. It was used as a stopping and departure point for tourists, particularly for those travelling by steamboat between Killarney and Manitoulin Island. It remains a destination point for tourists, who can park their boats and venture into the restaurant on the property, to stroll through the community, or to launch a boat and explore the North Channel and area by water.

Based on available information, it has been determined that the property at 21 Channel Street meets criteria numbers 4, 7, 8, and 9 contained in Ontario Regulation 9/06.

# 6.0 Conclusions and Next Steps

This evaluation was prepared in consideration of data regarding the design, historical/associative, and contextual values within the Municipality of Killarney. This evaluation determined that the property at 21 Channel Street meets the criteria outlined in Ontario Regulation 9/06. Therefore, the Killarney Wharf retains cultural heritage value or interest.

The following recommendations are proposed:

1. Given that the Killarney Wharf was determined to meet the criteria outlined in Ontario Regulation 9/06, meaning that the property retains cultural heritage value or interest, a Heritage Impact Assessment (H.I.A.) of the wharf is required to evaluate the expected impacts to the property. Fieldwork, including photographic documentation of the structure and surroundings, should be carried out as part of the H.I.A. to confirm the existing conditions of the wharf and serve as a record of the wharf prior to its demolition.

2. This C.H.E.R. should be submitted by the proponent to heritage planning staff at the Municipality of Killarney, the Ministry of Citizenship and Multiculturalism, and any other interested stakeholders for review.

# 7.0 Statement of Cultural Heritage Value and Heritage Attributes

This section provides the description of the property, a description of its cultural heritage value or interest, and a list of associated heritage attributes.

## 7.1 Description of Property

The Killarney Wharf is located in the village of Killarney, which is within the larger Municipality of Killarney. It is located immediately south of Channel Street at the base of Charles Street within Killarney Channel. The wharf is owned by the Municipality of Killarney, was erected in 1951. The larger property consists of a combined wood and concrete wharf, a wooden finger dock, gravel parking lot, boat launch, and contemporary restaurant building. The wharf is a composite structure that employs natural materials like wood and stone alongside pre-cast and cast-in-place reinforced concrete. The main wharf measures 100 feet (30.5 metres) in length on the south elevation and measures approximately 20 feet (6.1 metres) in width. The west face adjacent to the boat launch is approximately 38 metres long. The wooden finger dock, constructed sometime in the 1950s after the main portion of the wharf, is approximately three metres wide and 25 metres long.

## 7.2 Cultural Heritage Value or Interest

Killarney Wharf has historical and associative value through its direct association with a key theme and activity, as well as people and institutions, that are significant in the local context. The wharf has a direct association with the themes of commerce, transportation, and with the activity of fishing. From the early nineteenth century onward, the wharf site has been an active spot in

Georgian Bay's commercial fishery. It has been a place for departing and arriving fishing boats, a site for packing and shipping fish, a site for selling and purchasing fish at the market, and, more recently, as a location for consuming fish at the restaurant on site. In terms of transportation, the wharf site has been a central point of departure and arrivals for people and goods until road access was made available in the early 1960s. Killarney Wharf also has a direct association with people and organizations that have been significant to the community. During the late nineteenth and early twentieth century, two brothers, James and Charles Noble, were the wharf owners. First operating under the name of Noble Brothers Co. Ltd., and later as the Dominion Fish Co. Ltd., they bought fish from local fishermen, organized fishing licences, and handled packing and distribution. These companies were subsidiaries of the larger A. Booth and Company trust, commonly known as the "Fish Trust".

Killarney Wharf has contextual value for the way it supports the character of the waterfront community. The wharf, including its publicly accessibly dockage and boat launch, significantly contributes to Killarney's commercial and tourism industries, given their focus along both Channel Street and the Killarney Channel. The wharf is also functionally and historically linked to its surroundings given that buildings in its vicinity have been associated with water-based activities including transportation, recreation, and tourism since at least the middle of the nineteenth century. Finally, the wharf is a landmark since, for many generations, it has been an important site for locals engaged in the fishing industry and for tourists arriving and departing the area and provided the only access point to the village until 1963 when Highway 637 was constructed.

## 7.3 Heritage Attributes

The heritage attributes associated with the Killarney Wharf that express the historical/associative and contextual values of the structure include:

- Its location on Channel Street at the foot of Charles Street;
- Its direct association with the historic commercial fishing industry on Georgian Bay;

- Its direct association with fishing moguls James and Charles Noble and their companies: Noble Brothers Co. Ltd. and the Dominion Fish Co. Ltd.; and,
- Its support of and significant contribution to commercial operations and to tourism, recreation, and transportation industries along the Killarney waterfront.

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# Appendix A: Qualified Persons Involved in the Project

**Lindsay Graves, M.A., C.A.H.P.**
**Senior Cultural Heritage Specialist, Assistant Manager - Cultural Heritage Division**

The Senior Project Manager for this Cultural Heritage Evaluation Report is **Lindsay Graves** (M.A., Heritage Conservation), Senior Cultural Heritage Specialist and Assistant Manager for the Cultural Heritage Division. She was responsible for: overall project scoping and approach; development and confirmation of technical findings and study recommendations; application of relevant standards, guidelines and regulations; and implementation of quality control procedures. Lindsay is academically trained in the fields of heritage conservation, cultural anthropology, archaeology, and collections management and has over 15 years of experience in the field of cultural heritage resource management. This work has focused on the assessment, evaluation, and protection of above ground cultural heritage resources. Lindsay has extensive experience undertaking archival research, heritage survey work, heritage evaluation and heritage impact assessment. She has also contributed to cultural heritage landscape studies and heritage conservation plans, led heritage commemoration and interpretive programs, and worked collaboratively with multidisciplinary teams to sensitively plan interventions at historic sites/places. In addition, she is a leader in the completion of heritage studies required to fulfill Class Environmental Assessment processes and has served as Project Manager for over 100 heritage assessments during her time at A.S.I. Lindsay is a member of the Canadian Association of Heritage Professionals.

**John Sleath, M.A.**
**Cultural Heritage Specialist, Project Manager - Cultural Heritage Division**

The Project Manager for this Cultural Heritage Evaluation Report is **John Sleath** (M.A.), who is a Cultural Heritage Specialist and Project Manager within the Cultural Heritage Division with A.S.I. He was responsible for the day-to-day

management activities, including scoping of research activities and site surveys and drafting of study findings and recommendations. John has worked in a variety of contexts within the field of cultural heritage resource management for the past 13 years, as an archaeologist and as a cultural heritage professional. In 2015 John began working in the Cultural Heritage Division researching and preparing a multitude of cultural heritage assessment reports and for which he was responsible for a variety of tasks including: completing archival research, investigating built heritage and cultural heritage landscapes, report preparation, historical map regression, and municipal consultation. Since 2018 John has been a project manager responsible for a variety of tasks required for successful project completion. This work has allowed John to engage with stakeholders from the public and private sector, as well as representatives from local municipal planning departments and museums. John has conducted heritage assessments across Ontario, with a focus on transit and rail corridor infrastructure including bridges and culverts.

**Michael Wilcox, P.h.D.**
**Historian - Cultural Heritage Division**

The report writer for this Cultural Heritage Evaluation Report is **Michael Wilcox** (P.h.D., History), who is a historian within the Cultural Heritage Division. He was responsible for preparing and contributing to background historical research, reviewing existing heritage inventories, and technical reporting for this project. His current responsibilities focus on identifying and researching historical documents as well as background research, assessment, and evaluation of cultural heritage resources in Ontario. He has over a decade of combined academic and workplace experience in conducting historical research and crafting reports, presentations, articles, films, and lectures on a wide range of Canadian history topics.

# Appendix B: Maps and Drawings

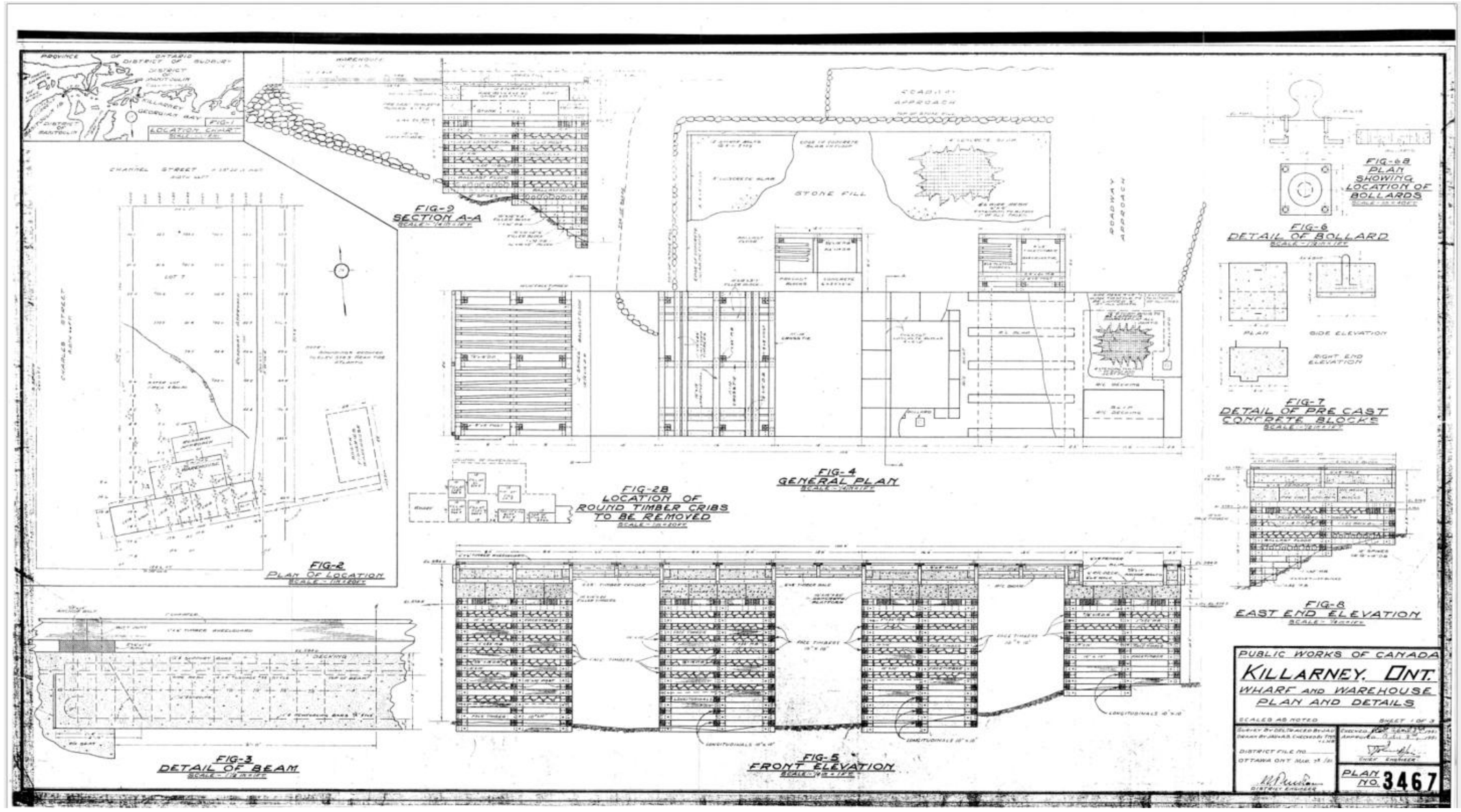



Figure 40: Plan No. 3467: Wharf and Warehouse Plan and Details, Killarney, Ont. (Sheet 1) (Public Works of Canada, 1951)

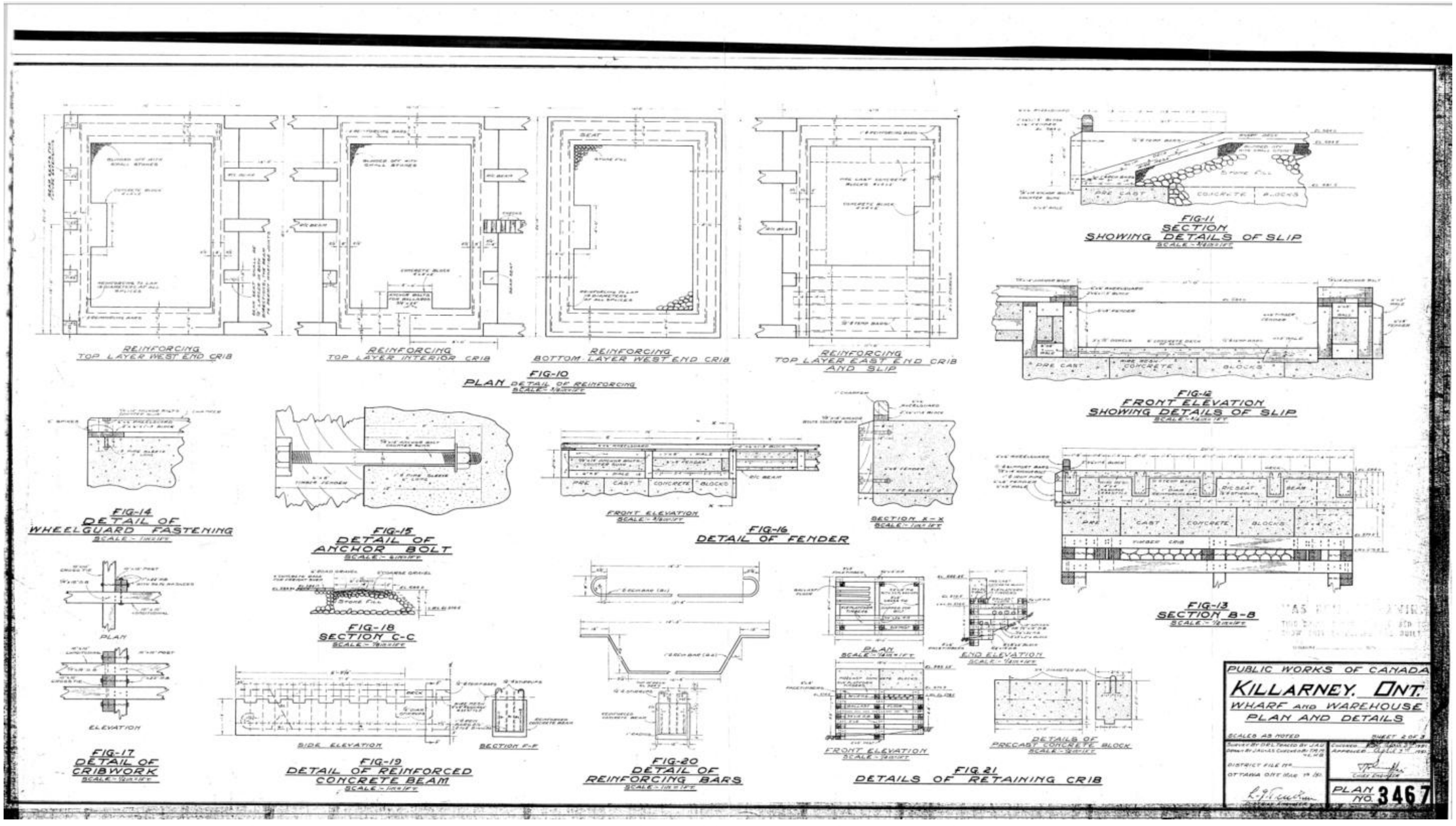



Figure 41: Plan No. 3467: Wharf and Warehouse Plan and Details, Killarney, Ont. (Sheet 2) (Public Works of Canada, 1951)

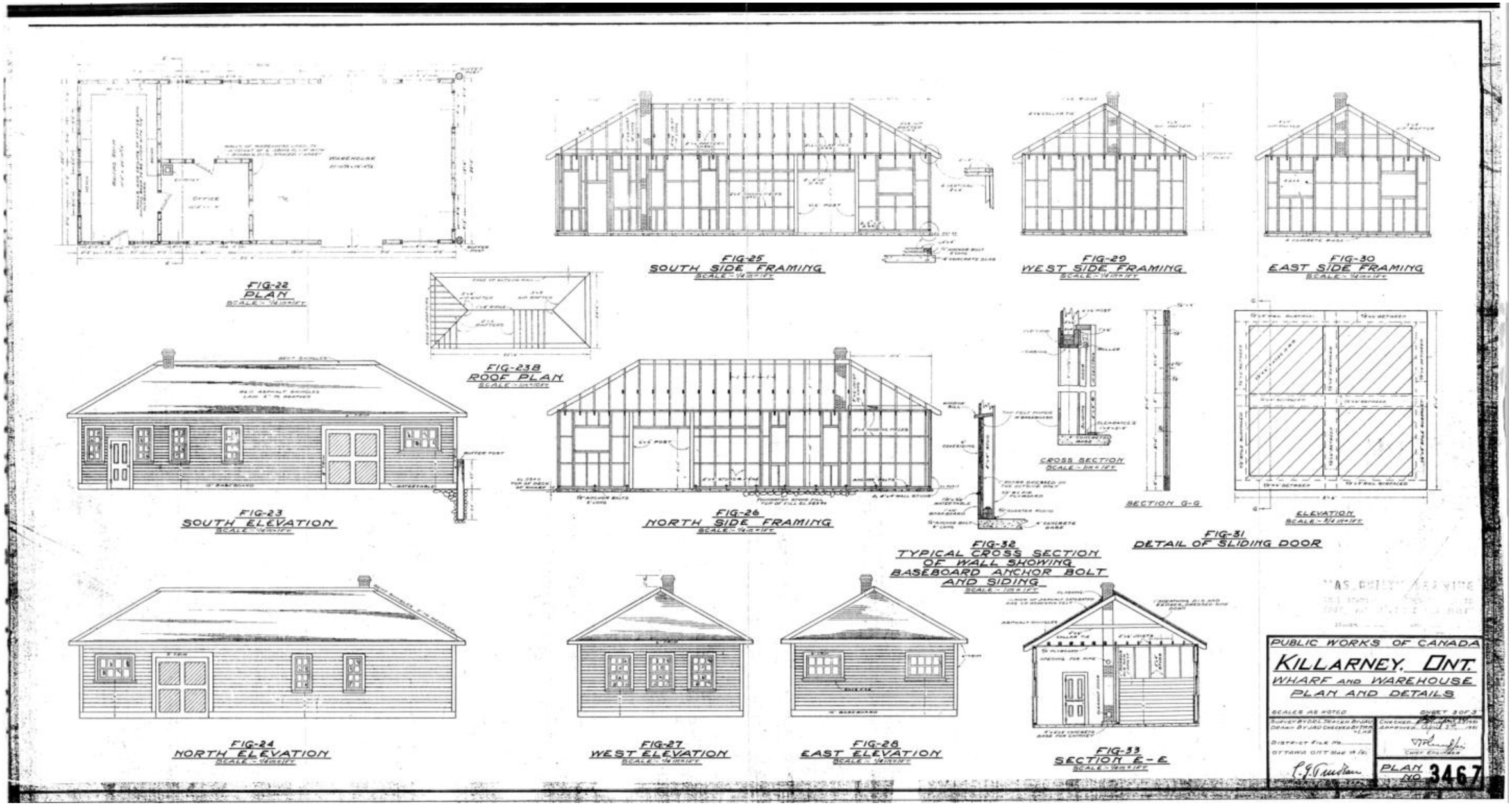



Figure 42: Plan No. 3467: Wharf and Warehouse Plan and Details, Killarney, Ont. (Sheet 3) (Public Works of Canada, 1951)

# Appendix C: Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes, A Checklist for the Non-Specialist

Ontario

**Ministry of Tourism, Culture and Sport**

Programs & Services Branch
401 Bay Street, Suite 1700
Toronto ON M7A 0A7

# Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes

## A Checklist for the Non-Specialist

The **purpose of the checklist** is to determine:

- if a property(ies) or project area:
    - is a recognized heritage property
    - may be of cultural heritage value
- it includes all areas that may be impacted by project activities, including – but not limited to:
    - the main project area
    - temporary storage
    - staging and working areas
    - temporary roads and detours

**Processes covered** under this checklist, such as:

- *Planning Act*
- *Environmental Assessment Act*
- *Aggregates Resources Act*
- *Ontario Heritage Act* – Standards and Guidelines for Conservation of Provincial Heritage Properties

**Cultural Heritage Evaluation Report (CHER)**

If you are not sure how to answer one or more of the questions on the checklist, you may want to hire a qualified person(s) (see page 5 for definitions) to undertake a cultural heritage evaluation report (CHER).

The CHER will help you:

- identify, evaluate and protect cultural heritage resources on your property or project area
- reduce potential delays and risks to a project

**Other checklists**

Please use a separate checklist for your project, if:

- you are seeking a Renewable Energy Approval under Ontario Regulation 359/09 – separate checklist
- your Parent Class EA document has an approved screening criteria (as referenced in Question 1)

Please refer to the Instructions pages for more detailed information and when completing this form.

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Project or Property Name

Killarney Wharf

Project or Property Location (upper and lower or single tier municipality)

21 Channel Street, Municipality of Killarney

Proponent Name

EXP Services Inc.

Proponent Contact Information

885 Regent Street, Suite 3-6A Sudbury, ON P3E 5M4

## Screening Questions

| | Yes | No |
|---|---|---|
| 1. Is there a pre-approved screening checklist, methodology or process in place? | ☐ | ☑ |

**If Yes,** please follow the pre-approved screening checklist, methodology or process.

**If No,** continue to Question 2.

## Part A: Screening for known (or recognized) Cultural Heritage Value

| | Yes | No |
|---|---|---|
| 2. Has the property (or project area) been evaluated before and found **not** to be of cultural heritage value? | ☐ | ☑ |

**If Yes,** do **not** complete the rest of the checklist.

The proponent, property owner and/or approval authority will:

- summarize the previous evaluation and
- add this checklist to the project file, with the appropriate documents that demonstrate a cultural heritage evaluation was undertaken

The summary and appropriate documentation may be:

- submitted as part of a report requirement
- maintained by the property owner, proponent or approval authority

**If No**, continue to Question 3.

| | Yes | No |
|---|---|---|
| 3. Is the property (or project area): | | |
| a. identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value? | ☐ | ☑ |
| b. a National Historic Site (or part of)? | ☐ | ☑ |
| c. designated under the *Heritage Railway Stations Protection Act*? | ☐ | ☑ |
| d. designated under the *Heritage Lighthouse Protection Act*? | ☐ | ☑ |
| e. identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office (FHBRO)? | ☐ | ☑ |
| f. located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site? | ☐ | ☑ |

**If Yes** to any of the above questions, you need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report, if a Statement of Cultural Heritage Value has not previously been prepared or the statement needs to be updated

If a Statement of Cultural Heritage Value has been prepared previously and if alterations or development are proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

**If No**, continue to Question 4.

## Part B: Screening for Potential Cultural Heritage Value

| | Yes | No |
|---|---|---|
| 4. Does the property (or project area) contain a parcel of land that: | | |
| a. is the subject of a municipal, provincial or federal commemorative or interpretive plaque? | ☐ | ☑ |
| b. has or is adjacent to a known burial site and/or cemetery? | ☐ | ☑ |
| c. is in a Canadian Heritage River watershed? | ☐ | ☑ |
| d. contains buildings or structures that are 40 or more years old? | ☑ | ☐ |

## Part C: Other Considerations

| | Yes | No |
|---|---|---|
| 5. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area): | | |
| a. is considered a landmark in the local community or contains any structures or sites that are important in defining the character of the area? | ☑ | ☐ |
| b. has a special association with a community, person or historical event? | ☑ | ☐ |
| c. contains or is part of a cultural heritage landscape? | ☐ | ☑ |

**If Yes** to one or more of the above questions (Part B and C), there is potential for cultural heritage resources on the property or within the project area.

You need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report (CHER)

If the property is determined to be of cultural heritage value and alterations or development is proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

**If No** to all of the above questions, there is low potential for built heritage or cultural heritage landscape on the property.

The proponent, property owner and/or approval authority will:

- summarize the conclusion
- add this checklist with the appropriate documentation to the project file

The summary and appropriate documentation may be:

- submitted as part of a report requirement e.g. under the *Environmental Assessment Act, Planning Act* processes
- maintained by the property owner, proponent or approval authority

## Instructions

Please have the following available, when requesting information related to the screening questions below:

- a clear map showing the location and boundary of the property or project area
    - large scale and small scale showing nearby township names for context purposes
- the municipal addresses of all properties within the project area
- the lot(s), concession(s), and parcel number(s) of all properties within a project area

For more information, see the Ministry of Tourism, Culture and Sport's Ontario Heritage Toolkit or Standards and Guidelines for Conservation of Provincial Heritage Properties.

In this context, the following definitions apply:

- **qualified person(s)** means individuals – professional engineers, architects, archaeologists, etc. – having relevant, recent experience in the conservation of cultural heritage resources.
- **proponent** means a person, agency, group or organization that carries out or proposes to carry out an undertaking or is the owner or person having charge, management or control of an undertaking.

### 1. Is there a pre-approved screening checklist, methodology or process in place?

An existing checklist, methodology or process may already be in place for identifying potential cultural heritage resources, including:

- one endorsed by a municipality
- an environmental assessment process e.g. screening checklist for municipal bridges
- one that is approved by the Ministry of Tourism, Culture and Sport (MTCS) under the Ontario government's Standards & Guidelines for Conservation of Provincial Heritage Properties [s.B.2.]

## Part A: Screening for known (or recognized) Cultural Heritage Value

### 2. Has the property (or project area) been evaluated before and found not to be of cultural heritage value?

Respond 'yes' to this question, if all of the following are true:

A property can be considered not to be of cultural heritage value if:

- a Cultural Heritage Evaluation Report (CHER) - or equivalent - has been prepared for the property with the advice of a qualified person and it has been determined not to be of cultural heritage value and/or
- the municipal heritage committee has evaluated the property for its cultural heritage value or interest and determined that the property is not of cultural heritage value or interest

A property may need to be re-evaluated, if:

- there is evidence that its heritage attributes may have changed
- new information is available
- the existing Statement of Cultural Heritage Value does not provide the information necessary to manage the property
- the evaluation took place after 2005 and did not use the criteria in Regulations 9/06 and 10/06

**Note**: Ontario government ministries and public bodies [prescribed under Regulation 157/10] may continue to use their existing evaluation processes, until the evaluation process required under section B.2 of the Standards & Guidelines for Conservation of Provincial Heritage Properties has been developed and approved by MTCS.

To determine if your property or project area has been evaluated, contact:

- the approval authority
- the proponent
- the Ministry of Tourism, Culture and Sport

### 3a. Is the property (or project area) identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value e.g.:

i. designated under the *Ontario Heritage Act*

- individual designation (Part IV)
- part of a heritage conservation district (Part V)

**Individual Designation – Part IV**

A property that is designated:

- by a municipal by-law as being of cultural heritage value or interest [s.29 of the *Ontario Heritage Act*]
- by order of the Minister of Tourism, Culture and Sport as being of cultural heritage value or interest of provincial significance [s.34.5]. **Note**: To date, no properties have been designated by the Minister.

**Heritage Conservation District – Part V**

A property or project area that is located within an area designated by a municipal by-law as a heritage conservation district [s. 41 of the *Ontario Heritage Act*].

For more information on Parts IV and V, contact:

- municipal clerk
- Ontario Heritage Trust
- local land registry office (for a title search)

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ii. subject of an agreement, covenant or easement entered into under Parts II or IV of the *Ontario Heritage Act*

An agreement, covenant or easement is usually between the owner of a property and a conservation body or level of government. It is usually registered on title.

The primary purpose of the agreement is to:

- preserve, conserve, and maintain a cultural heritage resource
- prevent its destruction, demolition or loss

For more information, contact:

- Ontario Heritage Trust - for an agreement, covenant or easement [clause 10 (1) (c) of the *Ontario Heritage Act*]
- municipal clerk – for a property that is the subject of an easement or a covenant [s.37 of the *Ontario Heritage Act*]
- local land registry office (for a title search)

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iii. listed on a register of heritage properties maintained by the municipality

Municipal registers are the official lists - or record - of cultural heritage properties identified as being important to the community.

Registers include:

- all properties that are designated under the *Ontario Heritage Act* (Part IV or V)
- properties that have not been formally designated, but have been identified as having cultural heritage value or interest to the community

For more information, contact:

- municipal clerk
- municipal heritage planning staff
- municipal heritage committee

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iv. subject to a notice of:

- intention to designate (under Part IV of the *Ontario Heritage Act*)
- a Heritage Conservation District study area bylaw (under Part V of the *Ontario Heritage Act*)

A property that is subject to a **notice of intention to designate** as a property of cultural heritage value or interest and the notice is in accordance with:

- section 29 of the *Ontario Heritage Act*
- section 34.6 of the *Ontario Heritage Act.* **Note**: To date, the only applicable property is Meldrum Bay Inn, Manitoulin Island. [s.34.6]

An area designated by a municipal by-law made under section 40.1 of the *Ontario Heritage Act* as a **heritage conservation district study area**.

For more information, contact:

- municipal clerk – for a property that is the subject of notice of intention [s. 29 and s. 40.1]
- Ontario Heritage Trust

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v. included in the Ministry of Tourism, Culture and Sport's list of provincial heritage properties

Provincial heritage properties are properties the Government of Ontario owns or controls that have cultural heritage value or interest.

The Ministry of Tourism, Culture and Sport (MTCS) maintains a list of all provincial heritage properties based on information provided by ministries and prescribed public bodies. As they are identified, MTCS adds properties to the list of provincial heritage properties.

For more information, contact the MTCS Registrar at registrar@mtc.gov.on.ca.

**3b. Is the property (or project area) a National Historic Site (or part of)?**

National Historic Sites are properties or districts of national historic significance that are designated by the Federal Minister of the Environment, under the *Canada National Parks Act*, based on the advice of the Historic Sites and Monuments Board of Canada.

For more information, see the National Historic Sites website.

**3c. Is the property (or project area) designated under the *Heritage Railway Stations Protection Act*?**

The *Heritage Railway Stations Protection Act* protects heritage railway stations that are owned by a railway company under federal jurisdiction. Designated railway stations that pass from federal ownership may continue to have cultural heritage value.

For more information, see the Directory of Designated Heritage Railway Stations.

**3d. Is the property (or project area) designated under the *Heritage Lighthouse Protection Act*?**

The *Heritage Lighthouse Protection Act* helps preserve historically significant Canadian lighthouses. The Act sets up a public nomination process and includes heritage building conservation standards for lighthouses which are officially designated.

For more information, see the Heritage Lighthouses of Canada website.

**3e. Is the property (or project area) identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office?**

The role of the Federal Heritage Buildings Review Office (FHBRO) is to help the federal government protect the heritage buildings it owns. The policy applies to all federal government departments that administer real property, but not to federal Crown Corporations.

For more information, contact the Federal Heritage Buildings Review Office.

See a directory of all federal heritage designations.

**3f. Is the property (or project area) located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?**

A UNESCO World Heritage Site is a place listed by UNESCO as having outstanding universal value to humanity under the Convention Concerning the Protection of the World Cultural and Natural Heritage. In order to retain the status of a World Heritage Site, each site must maintain its character defining features.

Currently, the Rideau Canal is the only World Heritage Site in Ontario.

For more information, see Parks Canada – World Heritage Site website.

## Part B: Screening for potential Cultural Heritage Value

**4a. Does the property (or project area) contain a parcel of land that has a municipal, provincial or federal commemorative or interpretive plaque?**

Heritage resources are often recognized with formal plaques or markers.

Plaques are prepared by:

- municipalities
- provincial ministries or agencies
- federal ministries or agencies
- local non-government or non-profit organizations

For more information, contact:

- municipal heritage committees or local heritage organizations – for information on the location of plaques in their community
- Ontario Historical Society's Heritage directory – for a list of historical societies and heritage organizations
- Ontario Heritage Trust – for a list of plaques commemorating Ontario's history
- Historic Sites and Monuments Board of Canada – for a list of plaques commemorating Canada's history

**4b. Does the property (or project area) contain a parcel of land that has or is adjacent to a known burial site and/or cemetery?**

For more information on known cemeteries and/or burial sites, see:

- Cemeteries Regulations, Ontario Ministry of Consumer Services – for a database of registered cemeteries
- Ontario Genealogical Society (OGS) – to locate records of Ontario cemeteries, both currently and no longer in existence; cairns, family plots and burial registers
- Canadian County Atlas Digital Project – to locate early cemeteries

In this context, adjacent means contiguous or as otherwise defined in a municipal official plan.

**4c. Does the property (or project area) contain a parcel of land that is in a Canadian Heritage River watershed?**

The Canadian Heritage River System is a national river conservation program that promotes, protects and enhances the best examples of Canada's river heritage.

Canadian Heritage Rivers must have, and maintain, outstanding natural, cultural and/or recreational values, and a high level of public support.

For more information, contact the Canadian Heritage River System.

If you have questions regarding the boundaries of a watershed, please contact:

- your conservation authority
- municipal staff

**4d. Does the property (or project area) contain a parcel of land that contains buildings or structures that are 40 or more years old?**

A 40 year 'rule of thumb' is typically used to indicate the potential of a site to be of cultural heritage value. The approximate age of buildings and/or structures may be estimated based on:

- history of the development of the area
- fire insurance maps
- architectural style
- building methods

Property owners may have information on the age of any buildings or structures on their property. The municipality, local land registry office or library may also have background information on the property.

**Note**: 40+ year old buildings or structure do not necessarily hold cultural heritage value or interest; their age simply indicates a higher potential.

A building or structure can include:

- residential structure
- farm building or outbuilding
- industrial, commercial, or institutional building
- remnant or ruin
- engineering work such as a bridge, canal, dams, etc.

For more information on researching the age of buildings or properties, see the Ontario Heritage Tool Kit Guide Heritage Property Evaluation.

## Part C: Other Considerations

**5a. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) is considered a landmark in the local community or contains any structures or sites that are important to defining the character of the area?**

Local or Aboriginal knowledge may reveal that the project location is situated on a parcel of land that has potential landmarks or defining structures and sites, for instance:

- buildings or landscape features accessible to the public or readily noticeable and widely known
- complexes of buildings
- monuments
- ruins

**5b. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) has a special association with a community, person or historical event?**

Local or Aboriginal knowledge may reveal that the project location is situated on a parcel of land that has a special association with a community, person or event of historic interest, for instance:

- Aboriginal sacred site
- traditional-use area
- battlefield
- birthplace of an individual of importance to the community

**5c. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) contains or is part of a cultural heritage landscape?**

Landscapes (which may include a combination of archaeological resources, built heritage resources and landscape elements) may be of cultural heritage value or interest to a community.

For example, an Aboriginal trail, historic road or rail corridor may have been established as a key transportation or trade route and may have been important to the early settlement of an area. Parks, designed gardens or unique landforms such as waterfalls, rock faces, caverns, or mounds are areas that may have connections to a particular event, group or belief.

For more information on Questions 5.a., 5.b. and 5.c., contact:

- Elders in Aboriginal Communities or community researchers who may have information on potential cultural heritage resources. Please note that Aboriginal traditional knowledge may be considered sensitive.
- municipal heritage committees or local heritage organizations
- Ontario Historical Society's "Heritage Directory" - for a list of historical societies and heritage organizations in the province

An internet search may find helpful resources, including:

- historical maps
- historical walking tours
- municipal heritage management plans
- cultural heritage landscape studies
- municipal cultural plans

Information specific to trails may be obtained through Ontario Trails.

## Jean-Louis Gaudet

**From:** Sanket Shinde <sshinde@municipalityofkillarney.ca>
**Sent:** Tuesday, October 21, 2025 9:15 AM
**To:** Jean-Louis Gaudet
**Cc:** Mike Cornell; John Sleath
**Subject:** FW: MCM Response - Killarney Municipal Wharf Improvements MCEA [MCM File 0018005]

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Jean,

Please see the email below from the Director of Planning for confirmation that there are no comments.

Thanks,

Sanket

---

**From:** Matthew Dumont <planner@sepb.org>
**Sent:** October 20, 2025 11:31 AM
**To:** Sanket Shinde <sshinde@municipalityofkillarney.ca>; Nancy Roy <admin@sepb.org>
**Cc:** Candy Beauvais <cbeauvais@municipalityofkillarney.ca>; Gilles Legault <glegault@municipalityofkillarney.ca>
**Subject:** RE: MCM Response - Killarney Municipal Wharf Improvements MCEA [MCM File 0018005]

Morning Sanket,

I have reviewed the CHER report regarding the redesign and reconstruction of Killarney Wharf (21 Channel Street) for the Municipality of Killarney. I have no concerns with the Provincial Policy Statement, 2024, or with our Official Plan for the community of Killarney.

Regards,

**Matthew Dumont, MCIP, RPP**
Director of Planning
**Sudbury East Planning Board**
www.sepb.org
39 Lafontaine Street, Unit 4, P.O. Box 250
Warren ON P0H 2N0
Tel: 705-967-2174 Fax: 705-967-2177

Tel: 705-967-2174 Fax: 705-967-2177

# Appendix B-4
# MCM Comments on ESR and Related Correspondence

## Jean-Louis Gaudet

**From:** Leclerc, Erika (MCM) <erika.leclerc@ontario.ca>
**Sent:** Friday, February 9, 2024 10:54 AM
**To:** Jean-Louis Gaudet
**Cc:** kchampaigne; Stephen Ho; Barboza, Karla (She/Her) (MCM); EA Notices to NRegion (MECP)
**Subject:** MCM Response - Municipality of Killarney: Municipal Class EA for the Killarney Municipal Wharf Improvements - Notice of Completion
**Attachments:** 2024-02-09 KillarneyWharf_ESR_MCMComments.pdf; 2024-01-11 KillarnyWharfEA_Notice of Completion_2024 01 11.pdf

Some people who received this message don't often get email from erika.leclerc@ontario.ca. Learn why this is important

**CAUTION**: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear Jean-Louis Gaudet,

Thank you for sending the Notice of Study Completion for the above-mentioned project to the Ministry of Citizenship and Multiculturalism (MCM). Please find attached MCM's comments on this project.

Please do not hesitate to contact us if you have any questions.

Kind regards,

**Erika Leclerc** (she/her)
Heritage Planner
Ministry of Citizenship and Multiculturalism
(416) 305-0757 | erika.leclerc@ontario.ca

**Ministry of Citizenship and Multiculturalism**

Heritage Planning Unit
Heritage Branch
Citizenship, Inclusion and Heritage Division
5th Flr, 400 University Ave
Tel.: 416-305-0757

**Ministère des Affaires civiques et du Multiculturalisme**

Unité de la planification relative au patrimoine
Direction du patrimoine
Division des affaires civiques, de l'inclusion et du patrimoine
Tél.: 416-305-0757

February 9, 2024 Email Only

Stephen Ho, M.Eng., P.Eng.
Consultant Project Manager
EXP Services Inc.
885 Regent Street, Suite 3-6A
Sudbury, ON P3E 5M4
steve.ho@exp.com

| | | |
|---|---|---|
| **MCM File** | **:** | **0018005** |
| **Proponent** | **:** | **Municipality of Killarney** |
| **Subject** | **:** | **Municipal Class Environmental Assessment – Schedule C – Notice of Completion** |
| **Project** | **:** | **Killarney Municipal Wharf Improvements** |
| **Location** | **:** | **Municipality of Killarney** |

---

Dear Stephen Ho:

Thank you for providing the Ministry of Citizenship and Multiculturalism (MCM) with the Notice of Completion and the Environmental Study Report (ESR, dated January 9, 2024, and prepared by EXP Services Inc.) for the above-referenced project.

MCM's interest in this Environmental Assessment (EA) project relates to its mandate of conserving Ontario's cultural heritage.

**Project Summary**
The Municipality of Killarney has completed a Municipal Class EA study for improvements to the municipal wharf located at 21 Channel Street South in the Village of Killarney. This study was undertaken to address the wharf's deteriorating condition and to improve its resilience to elevated lake water levels.

The study was conducted as a "Schedule C" project under the Municipal Class EA (March 2023), which is approved under the *Ontario Environmental Assessment Act*. An ESR documenting the planning process undertaken, details of the study recommendations as well as potential impacts and mitigation measures, has been completed and is being made available for public review.

**Comments**
We have reviewed the ESR and find that cultural heritage due diligence has yet to be fully documented for the proposed project. We have the following comments and observations.

*Archaeological Resources*
A Stage 1 archaeological assessment (AA) was completed for this project (under Project Information Form (PIF) number P094-0330-2022). The report has been submitted to MCM and is awaiting review. MCM recommends that *Section 8.5.1* of the ESR specify the PIF number and status of the Stage 1 AA.

Please note that archaeological concerns have not been fully addressed until reports have been entered into the Ontario Public Register of Archaeological Reports where those reports recommend that:

1. the archaeological assessment of the project area is complete and
2. all archaeological sites identified by the assessment are either of no further cultural heritage value or interest (as per Section 48(3) of the Ontario Heritage Act) or that mitigation of impacts has been accomplished through excavation or an avoidance and protection strategy.

Proponents should wait to receive the MCM's review letter indicating that the report(s) has been entered into the Register before issuing a decision or proceeding with any ground disturbing activities.

*Section 8.5.1* of the ESR indicates that MCM's *Criteria for Evaluating Marine Archaeological Potential: A Checklist for Non-Marine Archaeologists* was completed for areas of potential in-water impacts. The ESR notes that the checklist determined the area of potential in-water impacts has low marine archaeological potential and therefore no marine assessment is required. A copy of the checklist is provided in Appendix B.

No supporting documentation was included with the checklist. The proponent should clarify with supporting documentation how it has concluded that the project area has been subjected to recent, extensive, and intensive disturbance (see question 8 of the checklist). If documentation cannot be provided, then a marine AA shall be undertaken.

*Built Heritage Resources and Cultural Heritage Landscapes*

*Section 8.5.2* of the ESR states that MCM's *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes* was completed to assess the study area, and further that there is low potential for built heritage resources and cultural heritage landscapes. A Cultural Heritage Evaluation Report (CHER) was therefore not completed for the study area.

We note that no supporting documentation was included with the checklist. *Section 6.1.1* of the ESR indicates that the wharf was originally built in 1951 and that the wharf underwent significant upgrades in 2013. The answer to question 4.d should therefore have been "yes." MCM recommends that the proponent clarify with supporting documentation why a CHER is not required. If documentation cannot be provided, then a CHER shall be undertaken by a qualified person to support this EA project.

Thank you for consulting MCM on this project. If you have any questions or require clarification, please do not hesitate to contact me.

Sincerely,

Erika Leclerc
Heritage Planner
Heritage Planning Unit
Erika.leclerc@ontario.ca

Copied to: Kelly Champaigne, Project Manager, Municipality of Killarney
Jean-Louis Gaudet, Project Coordinator, EXP Services Inc
EA Notices to Northern Region, MECP, eanotification.nregion@ontario.ca
Karla Barboza, Team Lead Heritage Planning Unit, MCM

It is the sole responsibility of proponents to ensure that any information and documentation submitted as part of their EA report or file is accurate. The Ministry of Citizenship and Multiculturalism (MCM) makes no representation or warranty as to the completeness, accuracy or quality of the any checklists, reports or supporting documentation submitted as part of the EA process, and in no way shall MCM be liable for any harm, damages, costs, expenses, losses, claims or actions that may result if any checklists, reports or supporting documents are discovered to be inaccurate, incomplete, misleading or fraudulent.

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out an archaeological assessment, in compliance with Section 48(1) of the *Ontario Heritage Act*.

The *Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33* requires that any person discovering human remains must cease all activities immediately and notify the police or coroner. If the coroner does not suspect foul play in the disposition of the remains, in accordance with *Ontario Regulation 30/11* the coroner shall notify the Registrar, Ontario Ministry of Public and Business Service Delivery, which administers provisions of that Act related to burial sites. In situations where human remains are associated with archaeological resources, the Ministry of Citizenship and Multiculturalism should also be notified (at archaeology@ontario.ca) to ensure that the archaeological site is not subject to unlicensed alterations which would be a contravention of the *Ontario Heritage Act*.

## Jean-Louis Gaudet

**From:** Jean-Louis Gaudet
**Sent:** Wednesday, July 10, 2024 12:22 PM
**To:** 'Leclerc, Erika (MCM)'
**Cc:** Stephen Ho; Barboza, Karla (She/Her) (MCM); EA Notices to NRegion (MECP); Mike Cornell; 'sshinde@municipalityofkillarney.ca'; Candy Beauvais
**Subject:** RE: MCM Response - Municipality of Killarney: Municipal Class EA for the Killarney Municipal Wharf Improvements - Notice of Completion
**Attachments:** 2024 07 10_Killarney ESR_Response to MCM Comments_with Attachment.pdf

Hi Erika,

We are just following up on your comments from February 9, 2024 on the Killarney Municipal Wharf Improvements ESR.

Please find EXP's responses attached.

Thank you for your inputs, and we hope this clarifies any questions the Ministry may have.

Regards,

Jean-Louis

**Jean-Louis Gaudet, B.Sc.**
EXP | Project Coordinator
t : +1.905.525.6069, 65031 | m : +1.416.728.6261 | e : jeanlouis.gaudet@exp.com
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**From:** Leclerc, Erika (MCM) <erika.leclerc@ontario.ca>
**Sent:** Friday, February 9, 2024 10:54 AM
**To:** Jean-Louis Gaudet <jeanlouis.gaudet@exp.com>
**Cc:** kchampaigne <kchampaigne@municipalityofkillarney.ca>; Stephen Ho <steve.ho@exp.com>; Barboza, Karla (She/Her) (MCM) <Karla.Barboza@ontario.ca>; EA Notices to NRegion (MECP) <eanotification.nregion@ontario.ca>
**Subject:** MCM Response - Municipality of Killarney: Municipal Class EA for the Killarney Municipal Wharf Improvements - Notice of Completion

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**CAUTION**: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Dear Jean-Louis Gaudet,

Thank you for sending the Notice of Study Completion for the above-mentioned project to the Ministry of Citizenship and Multiculturalism (MCM). Please find attached MCM's comments on this project.

Please do not hesitate to contact us if you have any questions.

Kind regards,

**Erika Leclerc** (she/her)
Heritage Planner
Ministry of Citizenship and Multiculturalism
(416) 305-0757 | erika.leclerc@ontario.ca

---

**From:** Jean-Louis Gaudet <jeanlouis.gaudet@exp.com>
**Sent:** January 11, 2024 8:40 PM
**To:** Jean-Louis Gaudet <jeanlouis.gaudet@exp.com>
**Cc:** kchampaigne <kchampaigne@municipalityofkillarney.ca>; Stephen Ho <steve.ho@exp.com>
**Subject:** Municipality of Killarney: Municipal Class EA for the Killarney Municipal Wharf Improvements - Notice of Completion

**CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.**

Good afternoon,

The Municipality of Killarney has completed a Schedule C Municipal Class Environmental Assessment (Class EA) study for improvements to the municipal wharf located at 21 Channel Street South in the Village of Killarney.

Please find attached the project's Notice of Completion.

An Environmental Study Report (ESR) has been prepared for the project and is being made available for public review. Subject to comments received following this Notice and the receipt of approvals, the Municipality intends to proceed with implementation of the recommended project as outlined in the ESR (funding dependent).

The ESR may be downloaded from the project website: http://municipalityofkillarney.ca/municipal-wharf/.

Interested persons may provide written comments to our project team by February 12, 2024. Please see the attached notice for contact information.

Regards,

Jean-Louis Gaudet

**Jean-Louis Gaudet, B.Sc.**
EXP | Project Coordinator
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July 10, 2024

Ms. Erika Leclerc
Heritage Planner
Ministry of Citizenship and Multiculturalism
Heritage Planning Unit, Heritage Branch
Citizenship, Inclusion and Heritage Division

Via E-mail: Erika.leclerc@ontario.ca

**Re: MCM File: 0018005 Killarney Municipal Wharf Improvements Schedule C MCEA**
**Response to Comments on the Environmental Study Report**

Dear Ms. Leclerc:

Thank you for the input of your team on the Environmental Study Report (ESR) for the Killarney Municipal Wharf Improvements Schedule C Municipal Class Environmental Assessment (EA).

We have reviewed your comments and provide our responses to them in the following table and attachments.

*Archaeological Resources*

| MCM Comment | Response |
|---|---|
| A Stage 1 archaeological assessment (AA) was completed for this project (under Project Information Form (PIF) number P094-0330-2022). The report has been submitted to MCM and is awaiting review. MCM recommends that Section 8.5.1 of the ESR specify the PIF number and status of the Stage 1 AA. | Thank you for this clarification. However, to avoid confusion over report version control, EXP recommends against opening the report for this minor edit for the following reasons:<br>• The client is aware of the status of the Stage 1 AA and the report's PIF Number.<br>• Section 15.4 (Permits and Approvals) specifically notes that, at the time of the posting of the ESR for public review:<br>  ○ The Stage 1 AA was to be submitted to MCM;<br>  ○ The report was to be reviewed by MCM to ensure it complies with the standards and guidelines issued by the Ministry and that the archaeological field work and report |

| MCM Comment | Response |
|---|---|
| | recommendations ensure the conservation, preservation, and protection of the cultural heritage of Ontario; and<br>○ A clearance letter will be issued by the Ministry once it feels all matters relating to archaeological sites within the project area have been addressed to the satisfaction of the Ministry.<br>We trust this description adequately conveys the status of the Stage 1 AA at the time the ESR was posted. |
| Please note that archaeological concerns have not been fully addressed until reports have been entered into the Ontario Public Register of Archaeological Reports where those reports recommend that:<br>1. the archaeological assessment of the project area is complete and<br>2. all archaeological sites identified by the assessment are either of no further cultural heritage value or interest (as per Section 48(3) of the Ontario Heritage Act) or that mitigation of impacts has been accomplished through excavation or an avoidance and protection strategy. | Understood. |
| Proponents should wait to receive the MCM's review letter indicating that the report(s) has been entered into the Register before issuing a decision or proceeding with any ground disturbing activities. | Understood. |


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| MCM Comment | Response |
|---|---|
| Section 8.5.1 of the ESR indicates that MCM's Criteria for Evaluating Marine Archaeological Potential: A Checklist for Non-Marine Archaeologists was completed for areas of potential in- water impacts. The ESR notes that the checklist determined the area of potential in-water impacts has low marine archaeological potential and therefore no marine assessment is required. A copy of the checklist is provided in Appendix B.<br><br>No supporting documentation was included with the checklist. The proponent should clarify with supporting documentation how it has concluded that the project area has been subjected to recent, extensive, and intensive disturbance (see question 8 of the checklist). If documentation cannot be provided, then a marine AA shall be undertaken. | The disturbance at and around the wharf has occurred due to past dredging and construction activities.<br><br>For example, the United States Environmental Protection Agency reported in 1974 that the Killarney Channel was a waterway with commercial status, and it was routinely dredged by the Federal Department of Public Works to maintain a 27-foot seaway depth[1].<br><br>Additionally, construction activities have taken place around the wharf periodically in recent decades that would have created disturbances. Examples of these are depicted in Attachment A through various maps and drawings. These examples include infill of the shoreline to create a parking lot at the wharf and installation of a watermain (off the west side of the wharf) to George Island, on the other side of the channel.<br><br>_____<br><br>*1. United States Environmental Protection Agency. Future Dredging Quantities in the Great Lakes. EPA-660/3-74-029. December 1974.* |


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## *Built Heritage Resources and Cultural Heritage Landscapes*

| MCM Comment | Response |
|---|---|
| Section 8.5.2 of the ESR states that MCM's Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes was completed to assess the study area, and further that there is low potential for built heritage resources and cultural heritage landscapes. A Cultural Heritage Evaluation Report (CHER) was therefore not completed for the study area.<br><br>We note that no supporting documentation was included with the checklist. Section 6.1.1 of the ESR indicates that the wharf was originally built in 1951 and that the wharf underwent significant upgrades in 2013. The answer to question 4.d should therefore have been "yes." MCM recommends that the proponent clarify with supporting documentation why a CHER is not required. If documentation cannot be provided, then a CHER shall be undertaken by a qualified person to support this EA project. | It was intended that the supporting information was included in the text and figures of ESR, and this is discussed here.<br><br>Aerial imagery shows that there are no structures on the wharf other than the Herbert Fisheries building and the boathouse.<br><br>The Herbert Fisheries building was built in 2013.<br><br>While the boathouse dates to 1951 or earlier, it was not included in this assessment because of the Municipality's intention to demolish it in response to an order from the municipal building inspector, as the boathouse has been deemed unsafe. At the Municipality's June 14, 2023 council meeting, the Municipality passed Resolution 23-228, which stated that "Be it resolved that further to the Order to Comply #23-101 dated May 31, 2023 from the Chief Building Official that the Municipality of Killarney demolish the boathouse structure located at 21 Channel Street as it is a hazard to the health/safety of persons;". The boathouse has since been removed.<br><br>Given the above, it was concluded that there are no buildings or structures on the wharf more 40 years old than would be impacted by the proposed works, and therefore the response to 4d was "no". |

Sincerely,

Jean-Louis Gaudet
Environmental Assessment Lead, EXP Services Inc.
*Attachment*

xc: Candy K. Beauvais, Clerk-Treasurer, Municipality of Killarney
Sanket Shinde, Project Coordinator, Municipality of Killarney
Stephen Ho, M.Eng., P.Eng., Consultant Project Manager, EXP Services Inc
Jason Scott, Manager, Sudbury District Office, MECP
Lilly Floerke, Assistant Project Officer, MECP


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## Attachment A: Evidence of Marine Disturbance at the Killarney Municipal Wharf

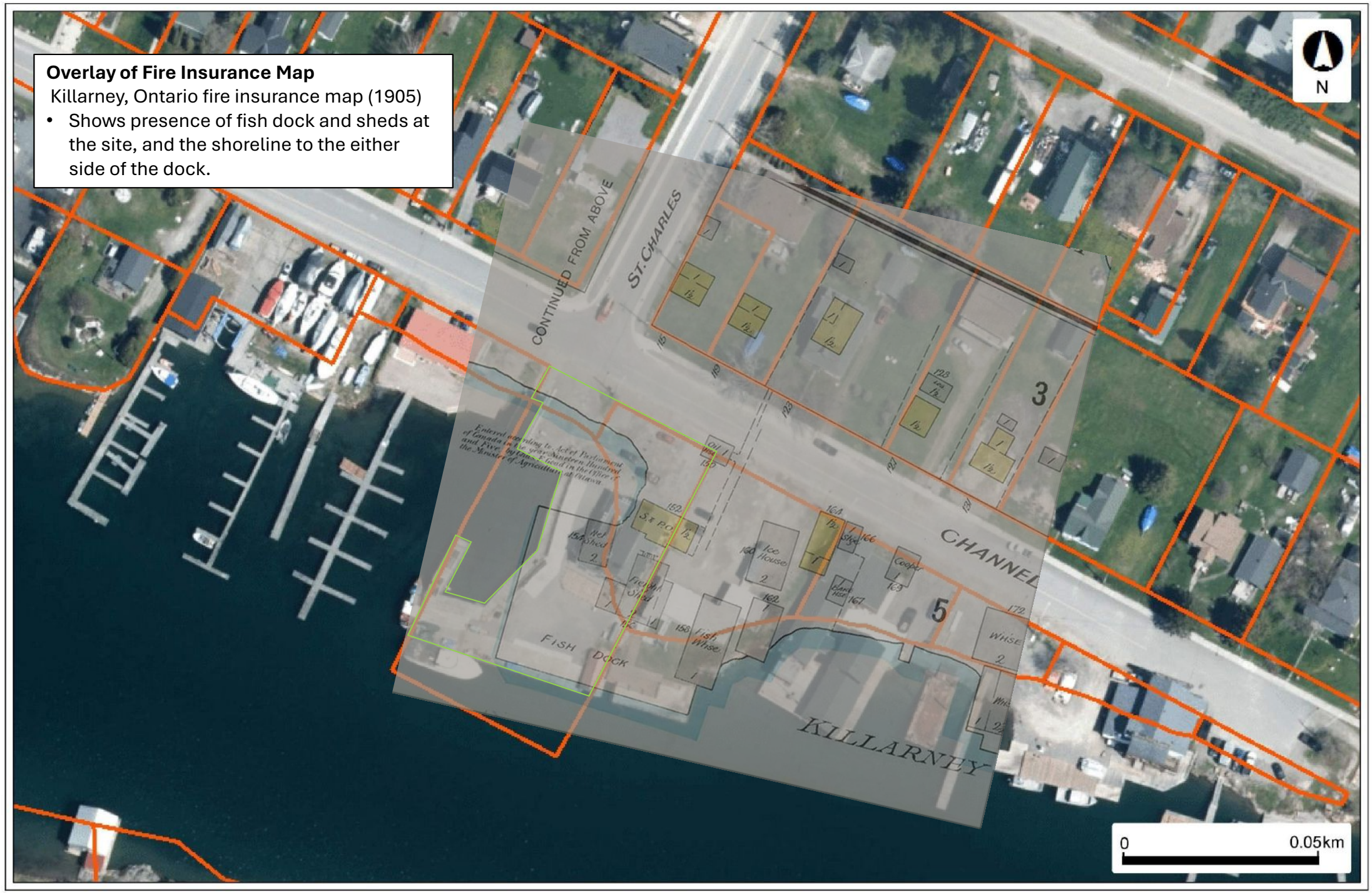
Includes:

- Aerial images depicting the project area, overlain with extracts from the following maps or drawings:
    - Ontario fire insurance map (1905).
    - Plan of Location Drawing on a Public Works of Canada "Wharf and Warehouse Plans and Details" drawing sheet (1951).
    - Drawing depicting water infrastructure at the Killarney Wharf, from As-Constructed Drawings for "Community of Killarney – Water Works Watermains" (1984).
    - Public Works Canada Water Lot Plan of Survey (1985).
    - Site Plan from the Killarney Wharf Renewal Project Issued for Construction Drawing Set As-Built Mark-ups (2013).
- Copy of the Public Works of Canada "Wharf and Warehouse Plans and Details" sheets (1951).
- Copy of the 1974 United States Environmental Protection Agency document "Future Dredging Quantities in the Great Lakes".

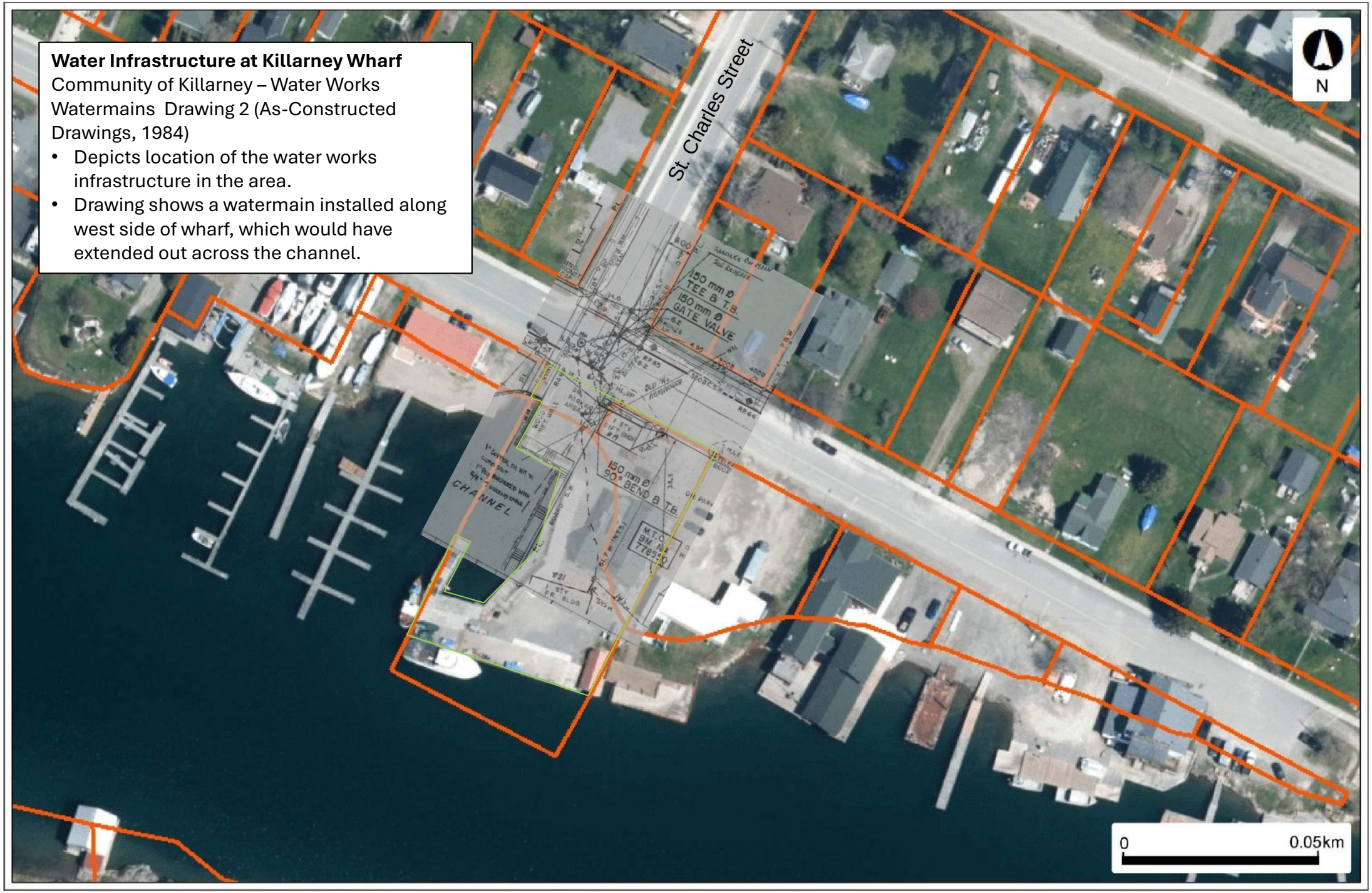
## Attachment A: Evidence of Marine Disturbance at the Killarney Municipal Wharf

Includes:

- Aerial images depicting the project area, overlain with extracts from the following maps or drawings:
    - Ontario fire insurance map (1905).
    - Plan of Location Drawing on a Public Works of Canada "Wharf and Warehouse Plans and Details" drawing sheet (1951).
    - Drawing depicting water infrastructure at the Killarney Wharf, from As-Constructed Drawings for "Community of Killarney – Water Works Watermains" (1984).
    - Public Works Canada Water Lot Plan of Survey (1985).
    - Site Plan from the Killarney Wharf Renewal Project Issued for Construction Drawing Set As-Built Mark-ups (2013).
- Copy of the Public Works of Canada "Wharf and Warehouse Plans and Details" sheets (1951).
- Copy of the 1974 United States Environmental Protection Agency document "Future Dredging Quantities in the Great Lakes".


Overlay of Fire Insurance Map
Killarney, Ontario fire insurance map (1905)
• Shows presence of fish dock and sheds at the site, and the shoreline to the either side of the dock.
CONTINUED FROM ABOVE
ST. CHARLES
CHANNEL
KILLARNEY
FISH DOCK
Ice House
Cooper
WHSE
3
5
N
0
0.05km


Plan of Location Drawing
Public Works of Canada Wharf and Warehouse Plans and Details drawing sheet (1951)
• Depicts the location of cribs, concrete dock, warehouse, and roadway approach constructed in the 1950's, as well as shoreline at that time.
St. Charles Street
N
0
0.05km


Water Infrastructure at Killarney Wharf
Community of Killarney – Water Works Watermains Drawing 2 (As-Constructed Drawings, 1984)
• Depicts location of the water works infrastructure in the area.
• Drawing shows a watermain installed along west side of wharf, which would have extended out across the channel.
St. Charles Street
150 mm Ø TEE & T.B.
150 mm Ø GATE VALVE
150 mm Ø 90° BEND & T.B.
CHANNEL
N
0
0.05km


Survey Plan
Public Works Canada Water Lot Plan of Survey (1985)
• Depicts location of concrete dock, wooden docks, and various buildings on site.
• Drawing shows that large portion of site filled in with gravel for parking lot and with wooden docks constructed.
St. Charles Street
N
0
0.05km


**Killarney Wharf Renewal Project**
Issued for Construction Drawing Set (2013), As-Built Mark-ups
{Site Plan, Fire Separation Plan, Code Review Sheet)
• Shows locations of constructed Herbert Fisheries building and of demolished buildings.
St, Charles Street
N
0
0.05km

# Killarney Channel




**Legend**

- Assessment Parcel

This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Environment, Conservation and Parks (MECP) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.

Ontario

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Map Created: 6/21/2024
Map Center: 45.97003 N, -81.51191 W

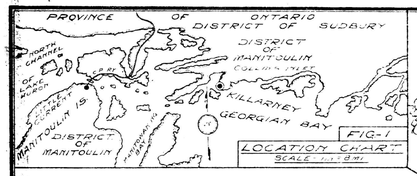


FIG-1

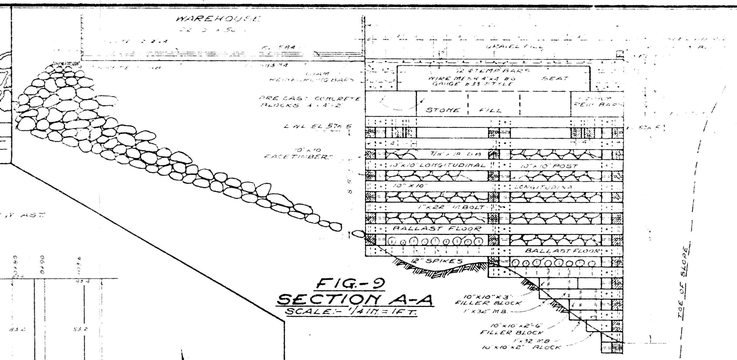


FIG-2
SECTION A-A
SCALE:- 1/4 IN = 1 FT.

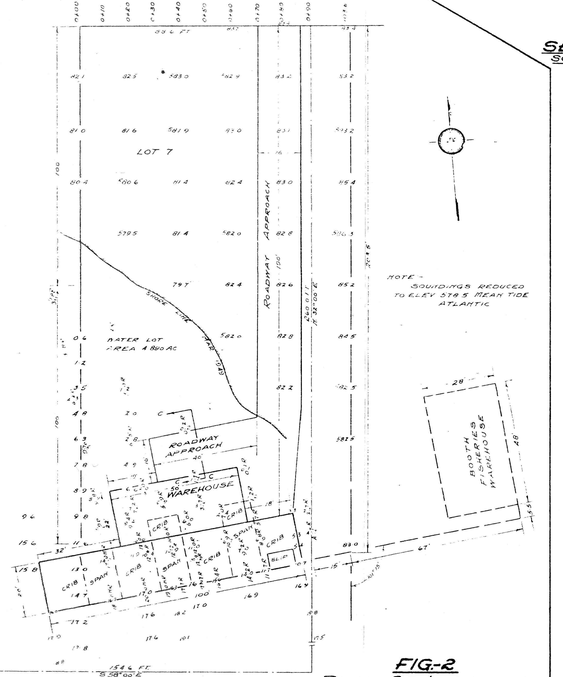


FIG-2
PLAN OF LOCATION
SCALE - 1 IN = 20 FT.



FIG-2
SECTION A-A
SCALE:- 1/4 IN = 1 FT.

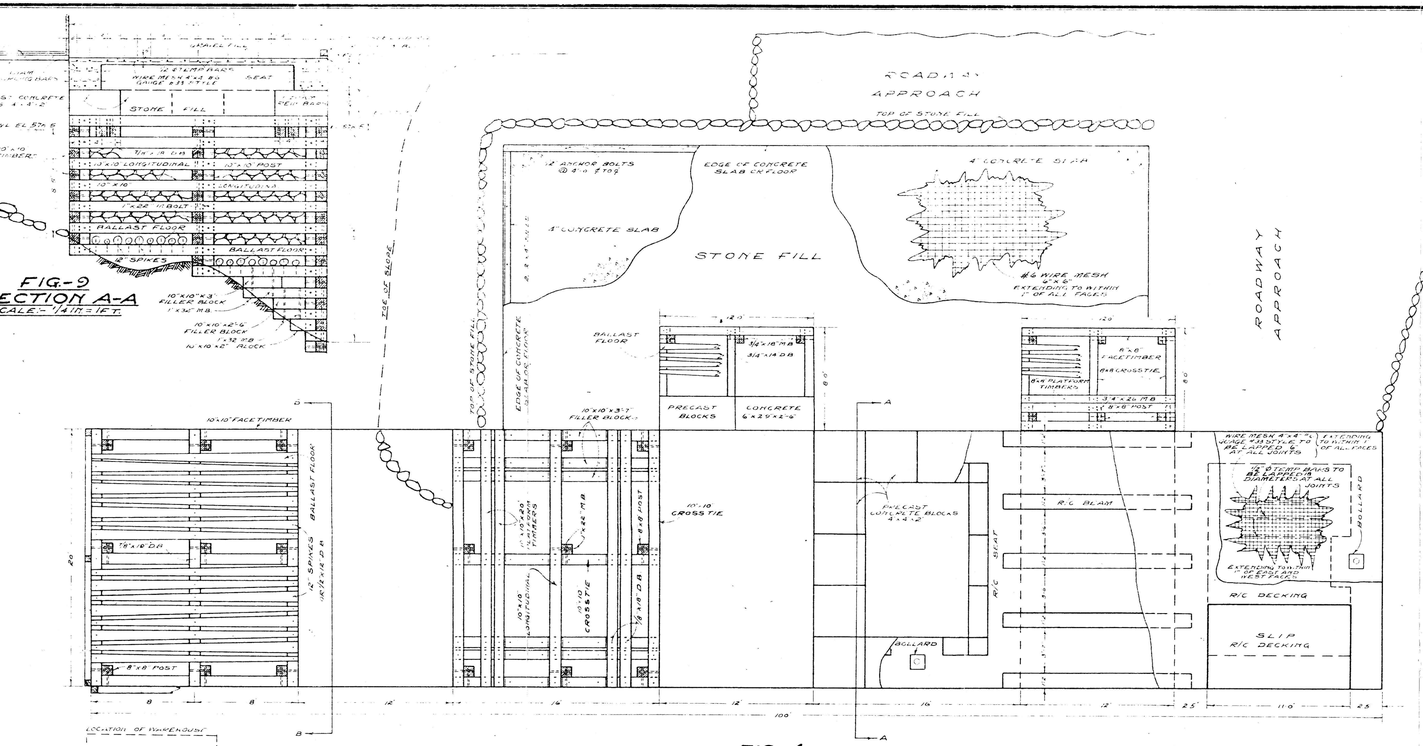


FIG-4
GENERAL PLAN
SCALE:- 1/4 IN = 1 FT.

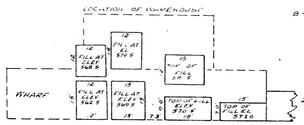


FIG-2B
LOCATION OF ROUND TIMBER CRIBS TO BE REMOVED
SCALE:- 1 IN = 20 FT.

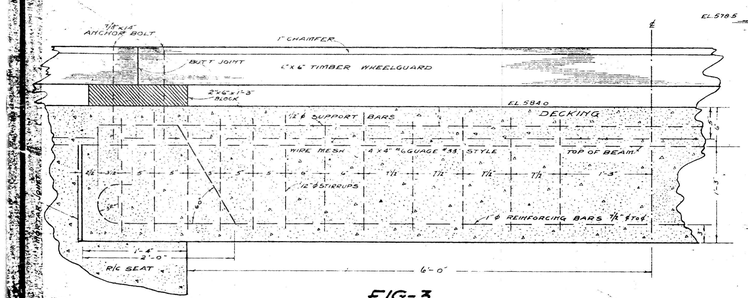


FIG-3
DETAIL OF BEAM
SCALE:- 1 1/2 IN = 1 FT.

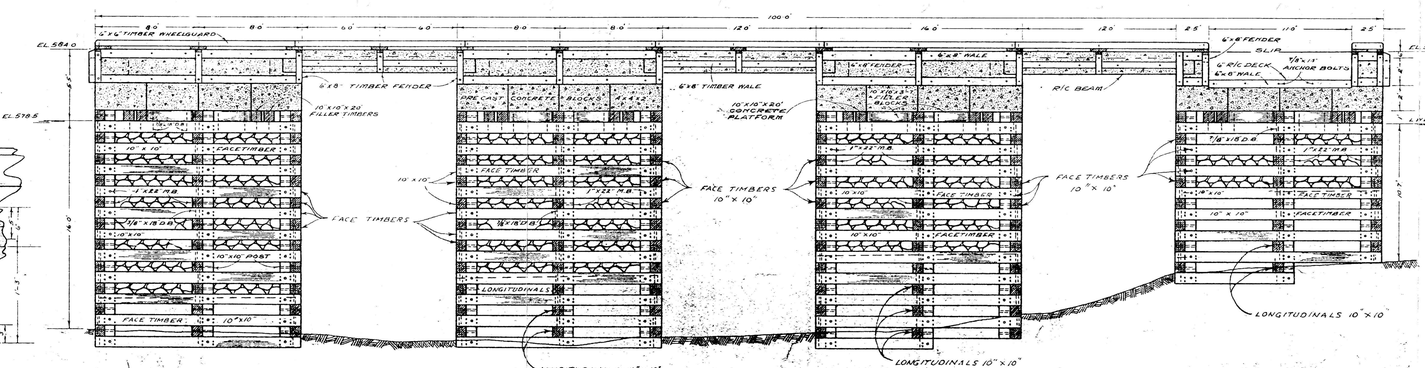


FIG-5
FRONT ELEVATION
SCALE:- 1/4 IN = 1 FT.

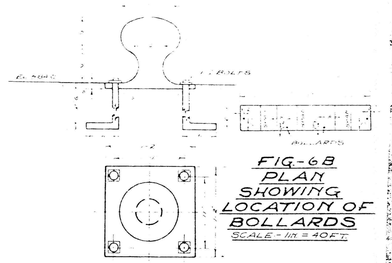


FIG-8
EAST END ELEVATION
SCALE:- 1/4 IN = 1 FT.



FIG-6B
PLAN SHOWING LOCATION OF BOLLARDS
SCALE - 1 IN = 40 FT.



FIG-6
DETAIL OF BOLLARD
SCALE - 1 1/2 IN = 1 FT.



FIG-7
DETAIL OF PRE CAST CONCRETE BLOCKS
SCALE:- 1 1/2 IN = 1 FT.

PUBLIC WORKS OF CANADA

# KILLARNEY, ONT.

## WHARF AND WAREHOUSE PLAN AND DETAILS

SCALES AS NOTED — SHEET 1 OF 3

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DRAWN BY JAU & A.S. CHECKED BY THE [illegible] L.M.M.

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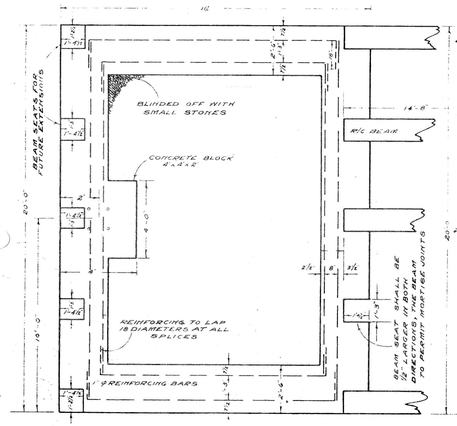
OTTAWA ONT. MAR. 7th 1951

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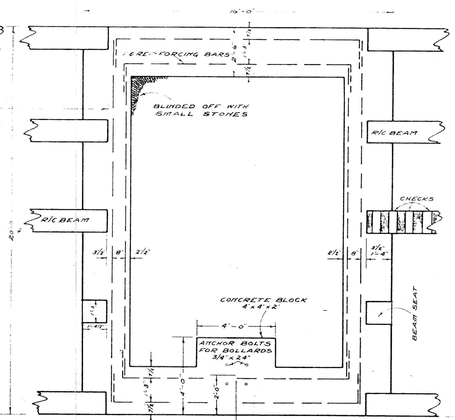
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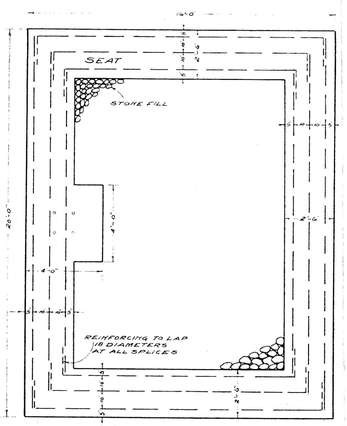
PLAN NO. 3467



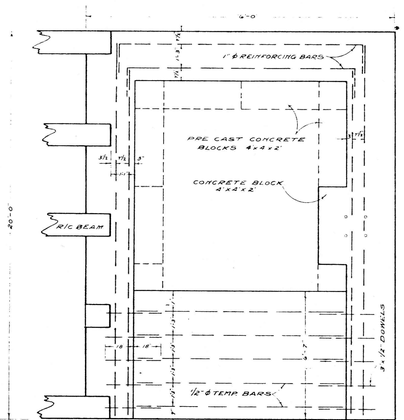

REINFORCING
TOP LAYER WEST END CRIB




REINFORCING
TOP LAYER INTERIOR CRIB




REINFORCING
BOTTOM LAYER WEST END CRIB




REINFORCING
TOP LAYER EAST END CRIB AND SLIP

FIG-10
PLAN DETAIL OF REINFORCING
SCALE:- 3/8 IN=1FT.

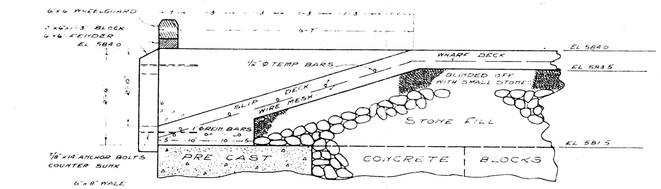



FIG-11
SECTION
SHOWING DETAILS OF SLIP
SCALE:- 3/4 IN=1FT.

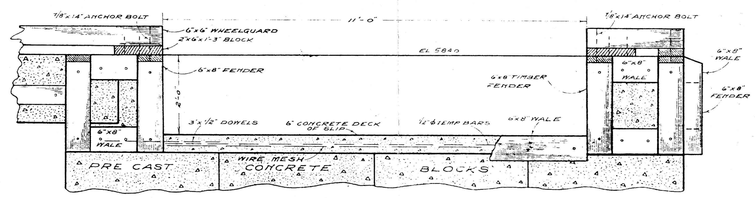



FIG-12
FRONT ELEVATION
SHOWING DETAILS OF SLIP
SCALE:- 3/4 IN=1FT.




FIG-14
DETAIL OF
WHEELGUARD FASTENING
SCALE:- 1 IN=1FT.

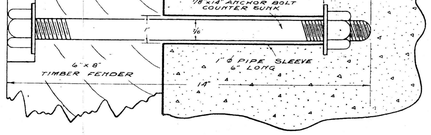
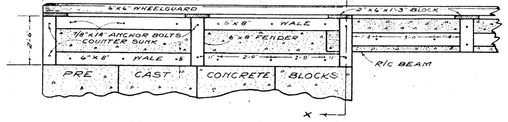
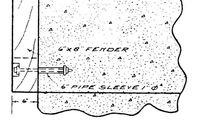



FIG-15
DETAIL OF
ANCHOR BOLT
SCALE:- 6 IN=1FT.




FRONT ELEVATION
SCALE:- 3/8 IN=1FT.




SECTION X-X
SCALE:- 1 IN=1FT.

FIG-16
DETAIL OF FENDER

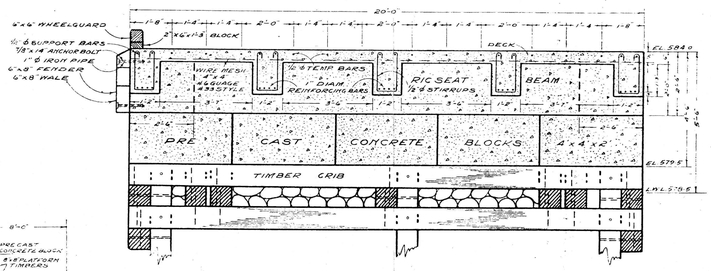



FIG-13
SECTION B-B
SCALE:- 1/2 IN=1FT.

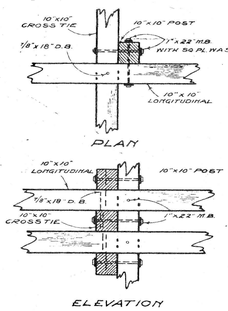



FIG-17
DETAIL OF
CRIBWORK
SCALE:- 1/2 IN=1FT.

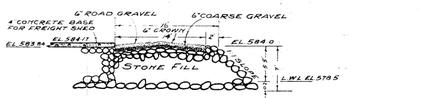



FIG-18
SECTION C-C
SCALE:- 1/8 IN=1FT.

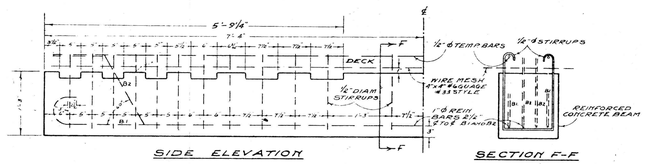



FIG-19
DETAIL OF REINFORCED
CONCRETE BEAM
SCALE:- 1 IN=1FT.

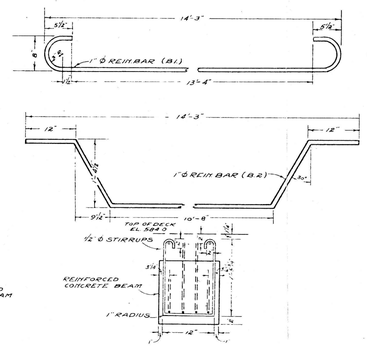
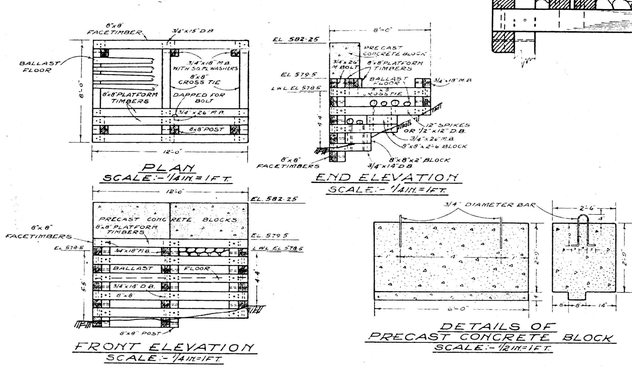



FIG-20
DETAIL OF
REINFORCING BARS
SCALE:- 1 IN=1FT.







DETAILS OF
PRECAST CONCRETE BLOCK
SCALE:- 1/2 IN=1FT.

FIG. 21
DETAILS OF RETAINING CRIB

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# KILLARNEY, ONT.

WHARF AND WAREHOUSE
PLAN AND DETAILS

SCALES AS NOTED — SHEET 2 OF 3

SURVEY BY D.R.L TRACED BY J.A.L
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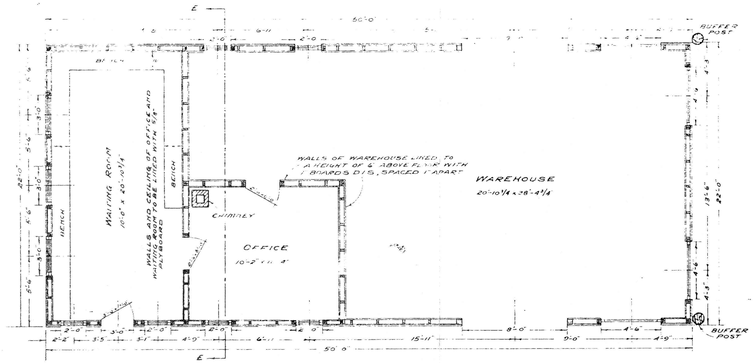



FIG-22
PLAN
SCALE:- 1/4 in = 1 ft.

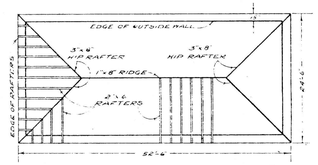



FIG-23B
ROOF PLAN
SCALE:- 1/8 in = 1 ft.

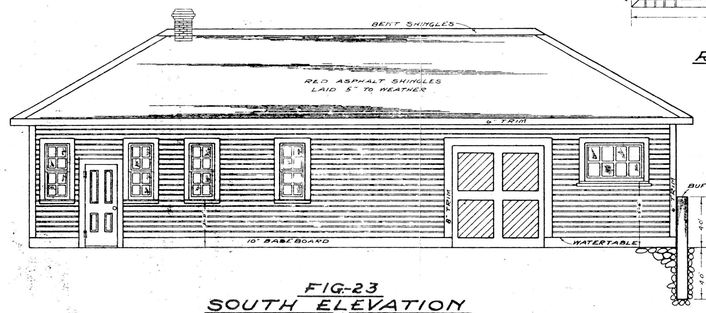



FIG-23
SOUTH ELEVATION
SCALE:- 1/4 in = 1 ft.

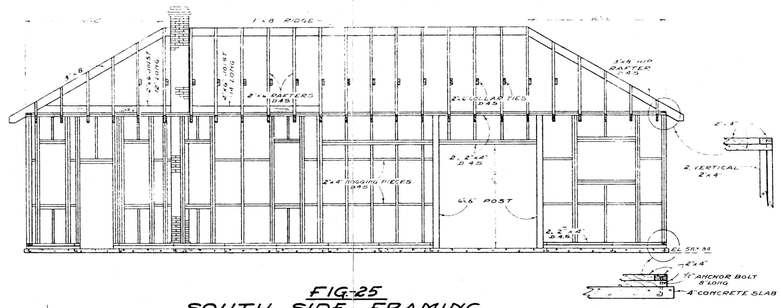



FIG-25
SOUTH SIDE FRAMING
SCALE:- 1/4 in = 1 ft.

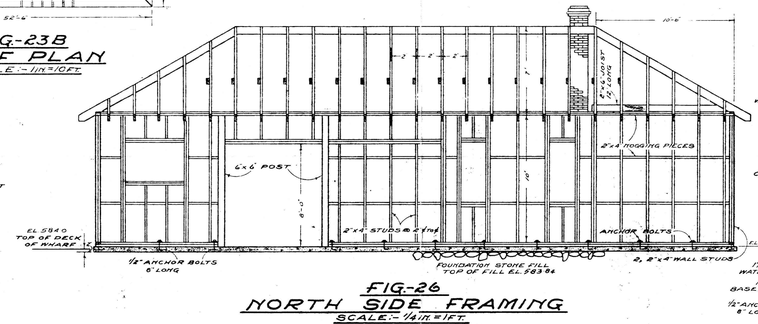



FIG-26
NORTH SIDE FRAMING
SCALE:- 1/4 in = 1 ft.

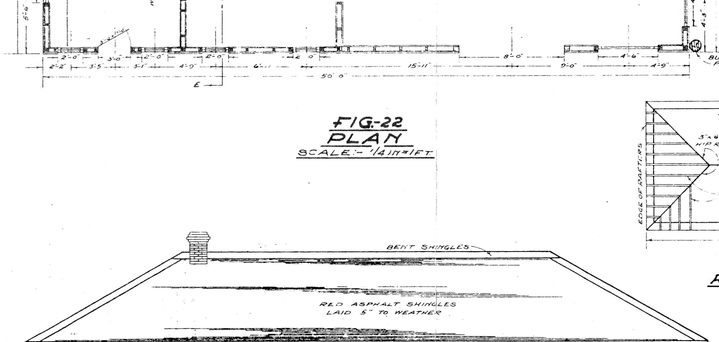



FIG-24
NORTH ELEVATION
SCALE:- 1/4 in = 1 ft.

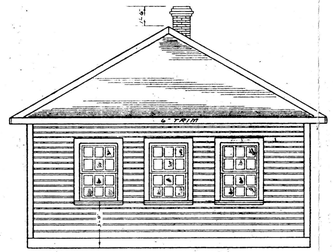



FIG-27
WEST ELEVATION
SCALE:- 1/4 in = 1 ft.

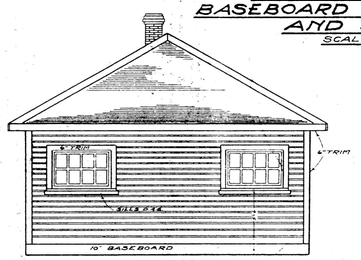



FIG-28
EAST ELEVATION
SCALE:- 1/4 in = 1 ft.

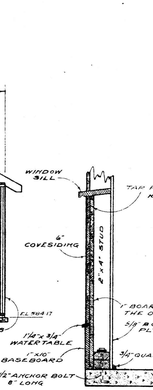



FIG-32
TYPICAL CROSS SECTION OF WALL SHOWING BASEBOARD ANCHOR BOLT AND SIDING
SCALE:- 1 in = 1 ft.

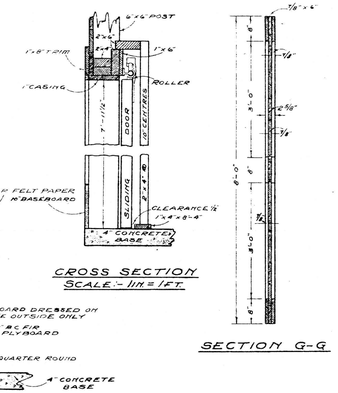
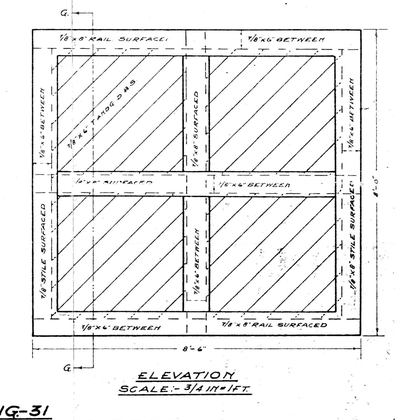






FIG-31
DETAIL OF SLIDING DOOR







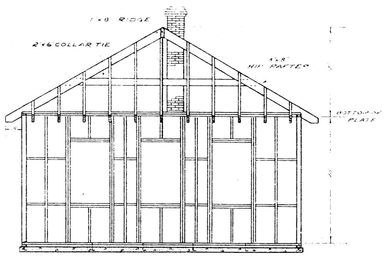



FIG-29
WEST SIDE FRAMING
SCALE:- 1/4 in = 1 ft.

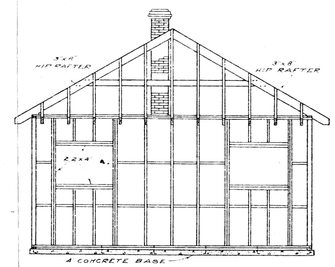



FIG-30
EAST SIDE FRAMING
SCALE:- 1/4 in = 1 ft.

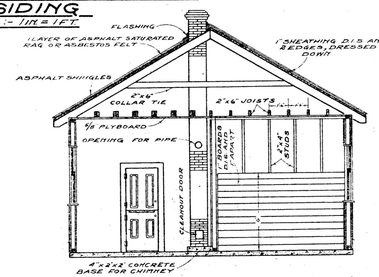



FIG-33
SECTION E-E
SCALE:- 1/4 in = 1 ft.

"AS BUILT" DRAWING
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# KILLARNEY, ONT.

WHARF AND WAREHOUSE

PLAN AND DETAILS

SCALES AS NOTED — SHEET 3 OF 3

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DRAWN BY J.A.U. CHECKED BY T.M.P. L.H.B.

DISTRICT FILE No.

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L.J. Gustin
CHIEF ARCHITECT

CHECKED T.M.P. 3/7/1951
APPROVED Chief 3rd /1951

CHIEF ENGINEER

PLAN NO. 3467

EPA-660/3-74-029
DECEMBER 1974

Ecological Research Series

# Future Dredging Quantities in the Great Lakes

National Environmental Research Center
Office of Research and Development
U.S. Environmental Protection Agency
Corvallis, Oregon 97330

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1. Environmental Health Effects Research
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This report has been assigned to the ECOLOGICAL RESEARCH STUDIES series. This series describes research on the effects of pollution on humans, plant and animal species, and materials. Problems are assessed for their long- and short-term influences. Investigations include formation, transport, and pathway studies to determine the fate of pollutants and their effects. This work provides the technical basis for setting standards to minimize undesirable changes in living organisms in the aquatic, terrestrial and atmospheric environments.

This report has been reviewed by the Office of Research and Development, EPA, and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

EPA-660/3-74-029
December 1974

# FUTURE DREDGING QUANTITIES

# IN THE GREAT LAKES

By

C. Nicholas Raphael
Eugene Jaworski
Carl F. Ojala
Daniel S. Turner

Grant Number R-801062
Program Element 1BA026
ROAP/Task No. 25ADX/03

Project Officer

Michael D. Mullin
Grosse Ile Laboratory
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Grosse Ile, Michigan 48138

NATIONAL ENVIRONMENTAL RESEARCH CENTER
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
CORVALLIS, OREGON 97330

ABSTRACT

Based on historical records, an overview and projection of U.S. and Canadian dredging quantities in the Great Lakes are presented. Using current pollution criteria, future quantities of polluted maintenance dredging are estimated for each lake. Recent environmental policies have influenced dredging and particularly disposal practices. These policies, as well as sedimentation, lake levels, and economics are discussed in relation to dredging.

During the next decade, maintenance and private dredging volumes will not change significantly, whereas new work will decrease. As in the past, most maintenance dredging will occur in U.S. projects, particularly in Lake Erie.

A factor which will determine future U.S. maintenance dredging is the availability of confined disposal sites. If the 62 sites are completed for commercial harbors as planned, 300,000 of the 6.45 million cubic yards of annual projected polluted spoil will not have disposal facilities. Where pollution elimination systems are in use, shoaling in some industrial harbors may be decreasing. Although long-term lake levels are not predictable, an inverse relationship between maintenance dredging and lake levels is evident.

This report was submitted in fulfillment of Project Number R-801062 and Grant Number R-801062 by Eastern Michigan University under the sponsorship of the Environmental Protection Agency. Work was completed as of July 1974.

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# SECTION I

# CONCLUSIONS

Based on the findings of this study, the following conclusions have been reached:

1. Future private, maintenance, and new work dredging quantities in the Great Lakes are projected to average 15.56 million cubic yards (CY) annually. Of this total, 78 percent will be removed from American harbors and connecting channels.

2. Of the future annual volume to be removed from United States' public dredging projects, 64 percent involves maintenance dredging, 19 percent consists of new work, and 17 percent involves private dredging. In Canada, these percentages are 31, 54, and 15, respectively.

3. Based on data of the U.S. Environmental Protection Agency (E.P.A.), 80 of the 117 American harbors and connecting channels sampled are polluted or partially polluted. According to the Ministry of Environment of Ontario (M.O.E.), 21 of the 31 Canadian navigation projects sampled contained polluted bottom sediments. Total polluted volumes for both countries are 6.45 and 1.01 million CY, respectively.

4. In the U.S. during the next decade, private dredging of non-federal projects is anticipated to average 2.01 million CY. Private spoil, routinely considered polluted by the E.P.A., is usually confined on the permitee's own land. In the future, private interests may dispose some of their spoil in federal disposal sites.

5. Maintenance dredging of public projects in the U.S. is projected to amount to 7.78 million CY annually. Approximately 83 percent of this total, i.e., 6.45 million CY, will involve polluted spoil which must be confined. Nearly 62 percent of this polluted volume will be derived from Lake Erie, including the Detroit River.

6. During periods of relatively low lake levels, as in the middle 1960's, annual maintenance dredging volumes are above average, particularly in Lakes Huron and Michigan.

7. New work projects scheduled for public harbors and waterways in the U.S. are expected to yield 2.25 million CY of dredging annually. Most of these projects involve new recreational harbors, not commercial harbors. Compared to the past decade, future new work will decline sharply. Because most new work dredgings consist of glacial till and/or bedrock, these materials usually need not be disposed in confined sites.

8. As of July 1974, there are 62 public harbors and waterways in the 10-year confined disposal program of the U.S. Army Corps of Engineers (C.E.). Eighteen other public harbors with polluted spoil were either dropped from the program or were not among the 73 projects initially selected. However, the total annual volume of polluted spoil from these 18 harbors averages only approximately 110,000 CY. A few heavily polluted projects, such as Toledo Harbor and Rouge River, have had confined disposal sites in operation prior to Public Law 91-611.

9. For 34 of the 62 navigation projects in the confined disposal program, selection of disposal sites has been completed and design of the confined facilities is progressing. Most of these projects involve large commercial harbors (e.g., Buffalo, Lorain, Milwaukee).

10. Some delays in the confined disposal program of the C.E. have been caused by the reluctance of local interests to provide land for disposal sites and by site approval difficulties. For 20 of the 62 navigation projects, there are neither existing confined disposal facilities, nor

has site selection been accomplished for the 10-year program. However, the polluted volume of these projects totals only about 300,000 CY annually, which is 5 percent of the total polluted volume (6.45 million CY). Recent high lake levels have reduced the problem of groundings at those harbors where maintenance dredging has been temporarily postponed while confined facilities are being designed.

11. Even though there is a trend toward larger lake carriers and extension of the navigation season, future maintenance dredging volumes are projected to increase only slightly, while new work volumes will decline.

12. Since the enactment of PL 91-611, disposal of polluted spoil in open-water sites has generally been discontinued in Lakes Superior, Michigan, Huron, and St. Clair. In the Buffalo District of the C.E., small quantities of polluted spoil are being open-lake disposed from harbors requiring maintenance dredging for which confined disposal sites have not yet been constructed.

13. At present, there is no specific legislation in the U.S. which prohibits the open-lake disposal of polluted spoil during times of economic stress. The governors of the states of Ohio, Pennsylvania, and New York have indicated to the C.E. that they will not object to open-lake dumping of polluted dredgings when suspension of maintenance dredging operations would jeopardize commercial navigation.

14. Dredging policies of Ontario, Canada, do not restrict the use of private land for confined disposal sites. In many instances, as in Toronto Harbor, the confined polluted spoil is utilized as a resource.

15. Where pollution elimination systems (under PL 92-500) have reduced artificial sedimentation, as in Calumet and Chicago Harbors, future maintenance and private dredging volumes may be lower than that of the past decade.

16. Although a very small increase in future average annual maintenance dredging is projected over the past decade, the proportion of polluted

spoil is expected to decrease slightly.

17. New guidelines by the E.P.A., governing the disposal of dredged materials in inland waters, will probably broaden the criteria for determining the eligibility of spoil for open-lake disposal. Although these guidelines may change the pollution status of several small recreational harbors currently classified as partially polluted, the future volume of polluted spoil which must be confined will not change significantly.

18. In partially polluted harbors, generally the inner harbor is polluted, whereas the outer harbor near the jetties and/or breakwater is unpolluted.

19. In rivermouth harbors, annual maintenance dredging volumes cannot be predicted on the basis of the sediment load being transported by the stream. For most harbors in the Great Lakes, the primary sources of the dredged sediments are industrial-municipal effluents, littoral drift, and alluvial deposition.

20. Wetlands, specifically coastal marshes, appear to be threatened less by C.E. spoil disposal than by high lake levels, filling by utilities and industries as well as by residential and recreational encroachment.

## SECTION II

## RECOMMENDATIONS

Based on data obtained and analyzed in this report, the following recommendations are presented:

1. Because of the relatively high cost of confined disposal, open-lake disposal of unpolluted dredged spoil should not be discontinued.

2. As in the Detroit District, other C.E. districts should distinguish, in their dredging records, between polluted and unpolluted maintenance dredging quantities.

3. Private dredging records, i.e., Section 10 and NWPA permit files, could be improved through standardization and higher priority.

4. The Department of Public Works of Canada (D.P.W.) should clearly distinguish, in their records, between maintenance and capital dredging.

5. As a first step in sediment abatement, the primary sources of sediment accumulation in each dredging project should be identified.

6. To reduce the future volume of polluted maintenance dredging, abatement of industrial and sewage inputs should be expanded.

7. Because pollution elimination systems have begun to reduce man-made sedimentation in some harbors, i.e., Calumet Harbor and River, the 10-year confined disposal program of the C.E. warrants continued support.

8. To improve the sampling of maintenance dredging projects, the D.P.W. and the C.E. should provide harbor shoaling maps to the M.O.E. and to

the E.P.A. In return, on the basis of their analyses, the M.O.E. and the E.P.A. should subdivide dredging projects into polluted and unpolluted sections. The M.O.E. should sample all public harbors which require maintenance dredging.

9. Practical uses of dredged spoil and of filled disposal sites should be emphasized in the U.S. as in Canada.

10. To facilitate the confinement of polluted spoil in the United States, disposal on private land should be further encouraged.

11. The filling of coastal wetlands with industrial wastes, and to some extent by dredged spoil, appears to be significant. These Great Lakes wetlands should be identified, mapped, and zoned to better facilitate future confined disposal site selection.

12. Because the cost of dredging operations in the Great Lakes' projects has increased considerably over the past decade, the C.E. should continue to perform public maintenance dredging so that competitive bidding with private dredgers may continue.

## SECTION III

## DREDGING QUANTITIES IN THE GREAT LAKES

### INTRODUCTION

Objectives of this section are to inventory the historical and current dredging volumes and to project future dredging quantities to be removed from private and public waterways of the Great Lakes in the United States and Canada. Dredging volume data were obtained from the district offices of the C.E., to include Buffalo, Chicago, Detroit and St. Paul, from the D.P.W. in Ottawa, Toronto, Sault Ste. Marie, Thunder Bay and London, and from district offices of the Ministry of Transport (M.O.T.) at Prescott and Parry Sound. In the Buffalo District, some data were derived through a review of private dredgers' field records. Finally, the E.P.A., Region V, Chicago, furnished some information regarding private dredging quantities.

In the Great Lakes, dredging operations are subdivided into three categories. New work, or capital dredging as it is referred to in Canada, involves deepening and/or widening of a pre-existing project, or the initiation of a new harbor or waterway. Maintenance dredging involves the removal of unconsolidated sediments which have been deposited in a navigation project since the last dredging operation. The D.P.W. of Canada does not always distinguish between capital dredging and maintenance dredging which, in some cases, may account for high maintenance dredging volumes in Canadian projects. Both new work and maintenance dredging operations in federal harbors and waterways are regulated by

the C.E. and the D.P.W. In Canada, all dredging in the Great Lakes is contracted out by the D.P.W. to public tenders, whereas in the United States the C.E. does perform some of the maintenance and new work dredging.

A third category of dredging is private, or permit dredging, which is done by private contractors in private harbors and in private approach channels and docks adjacent to federally-maintained channels of public harbors. Private dredging is regulated through the issuance of Section 10 and NWPA permits by the district offices of the C.E. and the M.O.T., respectively. In most districts, private dredging records are incomplete or were retained only for a few years before being destroyed. It was estimated that Section 10 files in the Chicago District of the C.E. are only 40 percent complete. In the past, high priority was not assigned to private dredging permits, especially with regard to remote areas of the Great Lakes. Thus, it was not possible to accurately determine the quality of spoil removed by private interests in the past. Therefore, all private dredging volumes in this section represent minimum quantities.

To present a uniform appraisal of dredging volumes for all the Great Lakes, this study presents all dredging quantities, however originally recorded, as place measure volumes. Because private and new work dredging volumes were generally recorded in place measure, conversion factors apply primarily to maintenance dredging volumes. Most Canadian data were recorded in place measure and few conversions were necessary. From the Corps of Engineers' Districts, conversion factors were obtained as indicated in Table 1. Based on their own specific operational function and dredging plant type, each Corps of Engineers' District uses a conversion factor which best represents the equivalent place measure volume. Bin measures are applicable to hydraulic and hopper dredge plants, whereas scow measures refer to dipper and clam shell dredges. Because of conversion to place measure, spoil volumes for individual harbors, projects

Table 1. CONVERSION FACTORS TO PLACE MEASURE (46)

| Lake | Bin measure | Scow measure |
|---|---|---|
| Ontario | 1 p.m. = 1.20 b.m. | 1 p.m. = 1.20 s.m. |
| Erie | 1.p.m. = 1.20 b.m. | 1 p.m. = 1.20 s.m. |
| Huron | 1 p.m. = 1.20 b.m. | 1 p.m. = 1.20 s.m. |
| Michigan | 1 p.m. = 1.50 b.m. | 1 p.m. = 1.20 s.m. |
| Superior | 1 p.m. = 1.05 b.m. | 1 p.m. = 1.05 s.m. |

or districts may not agree with the raw data available in the records of the C.E.

Estimates of future new work dredging quantities represent maximum volumes as all scheduled new work projects were tabulated. Projections of private and maintenance dredging quantities were based on dredging histories during the past decade. Although the effect of new work projects on the future maintenance dredging requirements of a given harbor was incorporated into projections of maintenance dredging volumes, other relevant factors such as federal funding, scheduling of dredging plants, lake levels, and availability of disposal sites were not. Because of the uniqueness of each dredging project and the affects of unknown variables such as future lake levels and federal funding, a single projection equation could not be applied to all harbors and waterways of the Great Lakes. Projections of future maintenance dredging by harbor has also been estimated by the C.E. for federal harbors in the United States (1). Both projections were compared and significant differences between the two are discussed below in the subsections on the individual lakes.

## DREDGING QUANTITIES IN LAKE ONTARIO

Lake Ontario is unique in its dredging requirements in that more material is removed from Canadian projects than from American projects. From 1961 to 1970, of the total amount of spoil dredged from Lake Ontario, 58 percent came from Canadian projects and 42 percent from projects completed by the C.E. The dredging demand for Canadian projects is greater; 7 projects required removal of a total of more than 100,000 cubic yards of spoil from 1961 to 1970. Only 4 American projects were dredged of at least 100,000 cubic yards of material in that period. The highest volumes on the Canadian side are generated primarily by the large commercial projects of Toronto and Hamilton, each with an annual average of more than 100,000 cubic yards of spoil removed. The only U.S. project with a comparable volume of spoil is Rochester. In addition to maintaining these and other smaller commercial harbors, a number of recreational/harbor refuge facilities on Lake Ontario are dredged. Nine projects on the Canadian side and 6 American harbors require dredging, at least periodically (Figure 1).

Average annual commerce at 3 American harbors on Lake Ontario is substantial enough so that the cost of their maintenance is unequivocally justified by the C.E. (2) (Figure 1). However, no American harbor on the lake is dredged to maintain the 27-foot St. Lawrence Seaway channel depth. Three Canadian harbors are dredged to Seaway depth. Other harbors with less commercial traffic, i.e., those with lower benefit/cost ratios, have frequently been dredged in the past. However, reductions in money allocations or port status changes could cause cessation of dredging operations at more marginal harbors such as Wilson, Olcott, or Little Sodus.

In terms of dredging volume, the most important American maintenance dredging projects are at Rochester and Oswego, which require removal of an average of 267,000 and 54,000 cubic yards of spoil every year respectively (Figure 2). The Canadian volume leaders are Toronto, Hamilton,

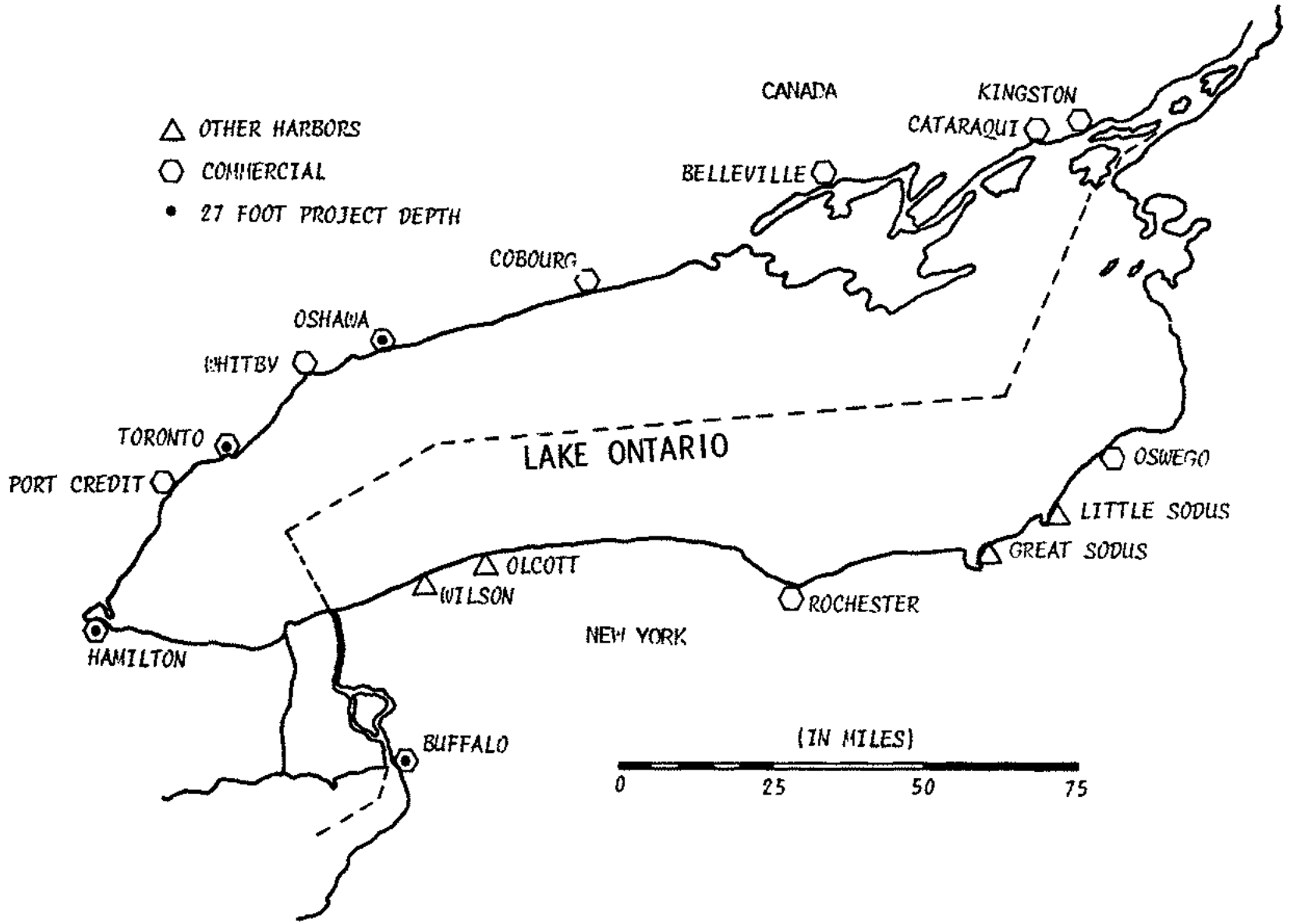



Figure 1. PRINCIPAL DREDGING PROJECTS IN LAKE ONTARIO

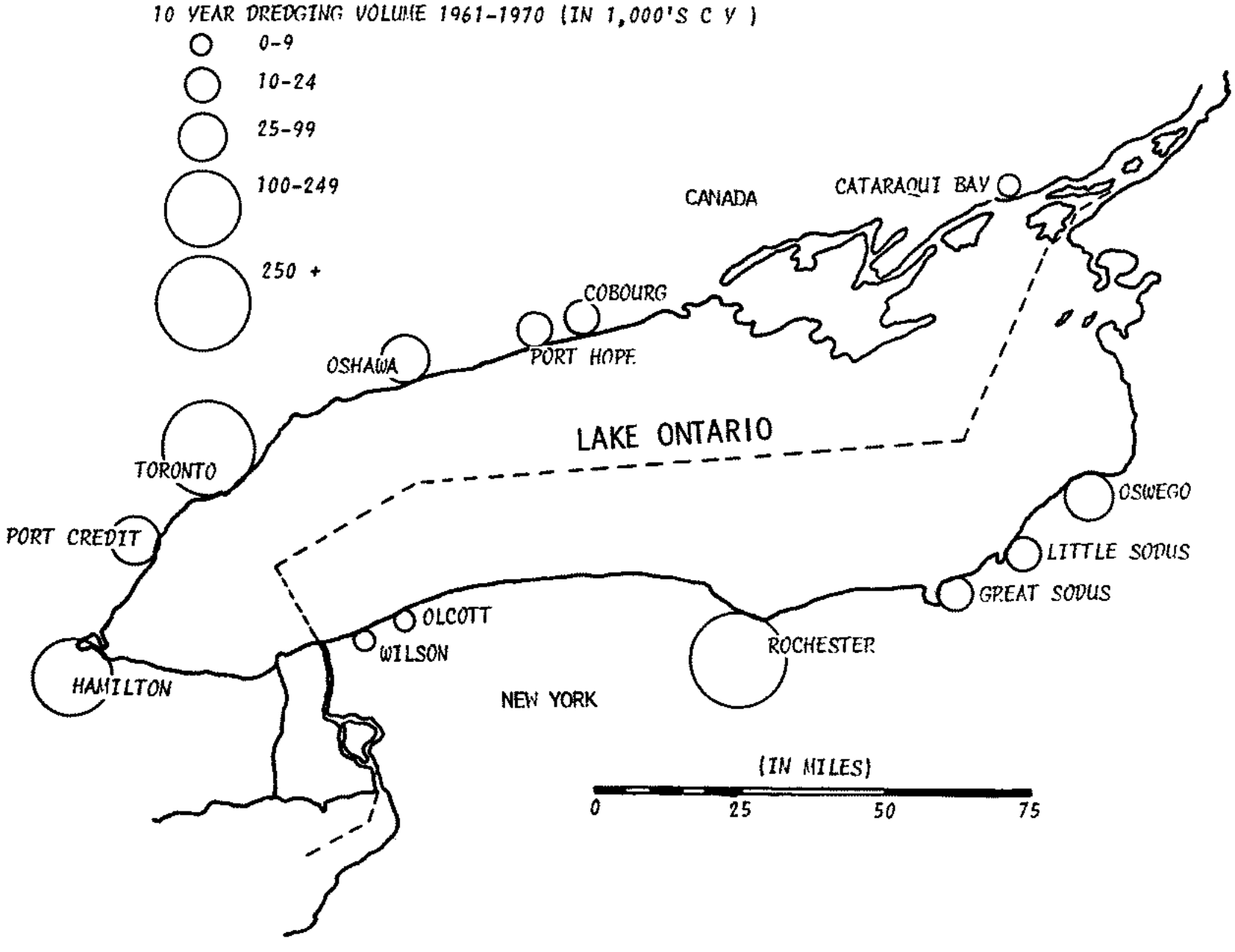



**Figure 2.** AVERAGE ANNUAL MAINTENANCE DREDGING VOLUMES IN LAKE ONTARIO, 1961-1970

Oshawa, and Port Credit, all requiring annual removal of more than 34,000 cubic yards of material. From 1961 to 1970, Rochester was the dredging volume leader, averaging 15,000 cubic yards more per year than Toronto.

## United States Dredging History in Lake Ontario

Lake Ontario has been dredged for decades, but complete, meaningful, and comparable volume data for Buffalo District C.E. projects are available only from 1951. Prior to that time, records on actual volumes dredged become sketchy to non-existent for some harbors, even in C.E. Annual Reports. In many cases, dollar cost figures were reported in lieu of volume data. Because of differences in types of material being removed, types and cost of dredging operations, accurate conversion of cost figures to volume figures was not possible for many of those earlier years. However, complete and meaningful maintenance and new work dredging data since 1951 were collected and collated (Table 2).

Table 2. HISTORICAL DREDGING IN LAKE ONTARIO BY HARBOR/WATERWAY, 1951-1972 (47)
(cubic yards)

| Harbor/waterway | Maintenance | New work | Total |
|---|---|---|---|
| Great Sodus | 459,910 | 0 | 459,910 |
| Little Sodus | 262,723 | 0 | 262,723 |
| Ogdensburg | 22,151 | 0 | 22,151 |
| Oswego | 1,113,538 | 355,561 | 1,469,099 |
| Rochester | 5,582,985 | 852,500 | 6,435,485 |
| Wilson | 16,139 | 0 | 16,139 |
| Olcott | 29,490 | 0 | 29,490 |
| Totals | 7,486,936 | 1,208,061 | 8,694,997 |

Since 1951 approximately 8.7 million cubic yards of spoil has been removed from Lake Ontario by the C.E. (Table 2). About 85 percent of the total was removed in maintenance dredging and 15 percent in new work projects. Of all material removed in maintenance projects since 1951, about nine-tenths came from Rochester and Oswego combined. In fact, almost three-fourths came from Rochester alone. The only new work dredging accomplished during the same period occurred at these two harbors.

Maintenance Dredging--

In the past decade, maintenance dredging has accounted for approximately 65 percent of all dredging on the American side of Lake Ontario. In terms of volume removed over a longer period, i.e., 1951 to 1972, the C.E. dredged an average of approximately 340,000 cubic yards of spoil from Lake Ontario projects annually. Absolute amounts ranged from a low of 182,000 cubic yards in 1971 to a high of 567,000 cubic yards in 1967 (Table 3). Thus, volumes of spoil removed from the American side of Lake Ontario have been fairly constant in recent years (Figure 3). Since 1951, the C.E. has been responsible for removing more than 7 million cubic yards of spoil from the lake in maintenance dredging projects.

New Work Dredging--

In the past decade, new work dredging has accounted for approximately 25 percent of all dredging activity on the American side of Lake Ontario. Over the longer term, i.e., 1951 to 1972, only about 1.2 million cubic yards of spoil were removed in new work dredging projects. However, unlike maintenance dredging, new work volumes display very little regularity from year to year. They range from a low of no new work in most years since 1951 to a high of more than 400,000 cubic yards of spoil removed in new work projects in 1963 (Table 4). No new work has occurred on the American side of Lake Ontario since 1966. For the most

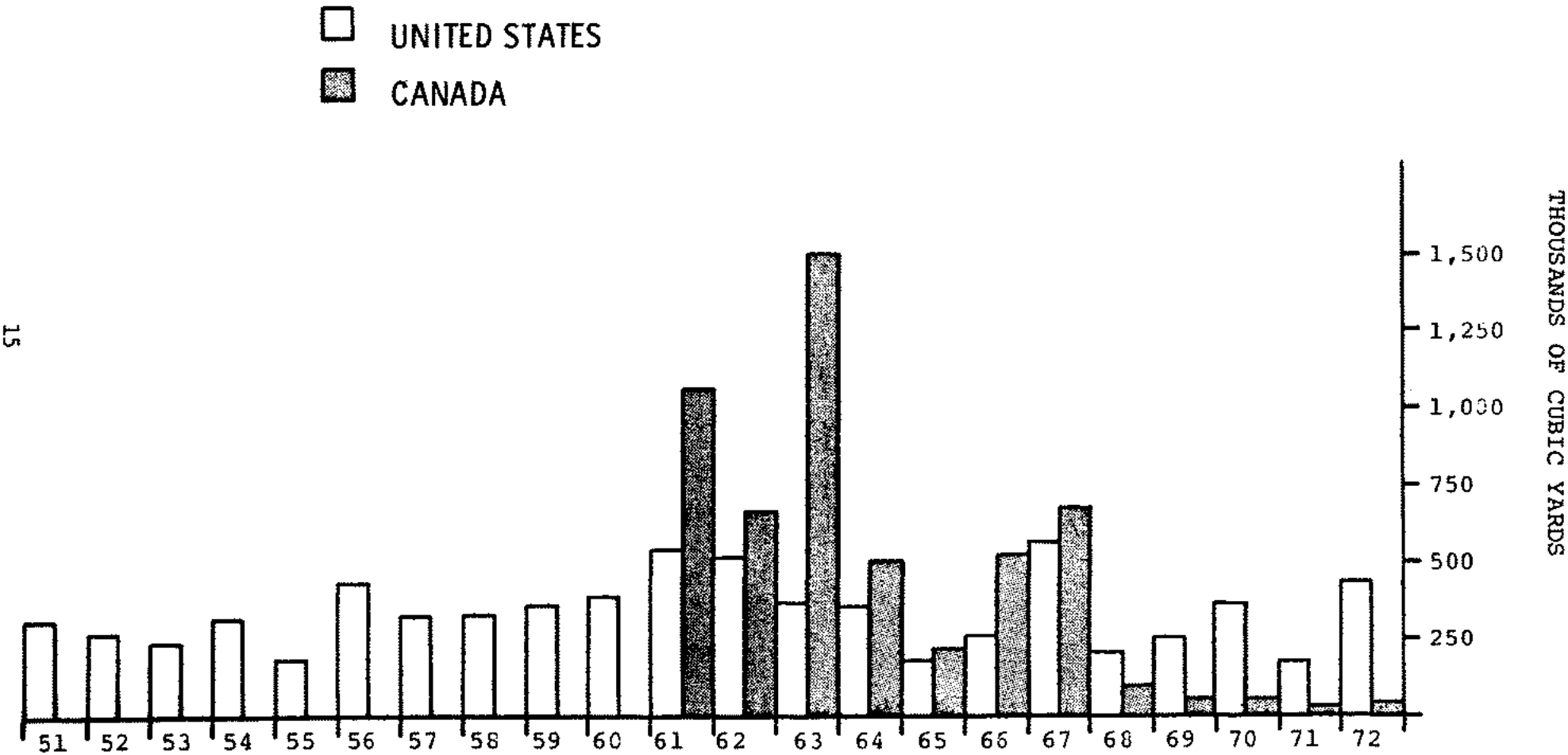



Figure 3. MAINTENANCE DREDGING VOLUMES IN LAKE ONTARIO, 1951-1972

Table 3. ANNUAL MAINTENANCE DREDGING IN LAKE ONTARIO, 1951-1972 (47)
(cubic yards)

| Year | Total volume |
|---|---|
| 1972 | 439,803 |
| 1971 | 182,019 |
| 1970 | 364,488 |
| 1969 | 256,050 |
| 1968 | 214,610 |
| 1967 | 567,766 |
| 1966 | 253,800 |
| 1965 | 188,273 |
| 1964 | 353,912 |
| 1963 | 376,429 |
| 1962 | 515,741 |
| 1961 | 548,480 |
| 1960 | 390,660 |
| 1959 | 366,636 |
| 1958 | 333,309 |
| 1957 | 343,114 |
| 1956 | 444,870 |
| 1955 | 186,885 |
| 1954 | 324,927 |
| 1953 | 245,879 |
| 1952 | 274,522 |
| 1951 | 314,763 |
| Total | 7,486,936 |

Table 4. NEW WORK DREDGING IN LAKE ONTARIO, 1951-1972 (47)
(cubic yards)

| Year | Total volume |
|---|---|
| 1972 | 0 |
| 1971 | 0 |
| 1970 | 0 |
| 1969 | 0 |
| 1968 | 0 |
| 1967 | 0 |
| 1966 | 284,860 |
| 1965 | 28,618 |
| 1964 | 278,583 |
| 1963 | 439,751 |
| 1962 | 134,166 |
| 1961 | 0 |
| 1960 | 0 |
| 1959 | 0 |
| 1958 | 35,416 |
| 1957 | 0 |
| 1956 | 6,667 |
| 1955 | 0 |
| 1954 | 0 |
| 1953 | 0 |
| 1952 | 0 |
| 1951 | 0 |
| Total | 1,208,061 |

part, this was due to the deepening and widening of harbors and waterways to accommodate new commerce generated by the 1959 completion of the St. Lawrence Seaway.

The largest new work project since 1951 occurred at Rochester in 1963, when more than one-half a million cubic yards of spoil were generated.

Permit Dredging--

Dredging by non-federal interests may only be undertaken when authorization of the C.E. is obtained through permits. Data were gathered from the C.E. District Office in Buffalo, from the E.P.A., Chicago, and from the New York State Department of Environmental Conservation in Albany. Permit dredging in Lake Ontario has been traced thoroughly to 1963. It is felt that compilation of permit dredging volume data is as complete as possible, considering certain restrictions such as missing permit files, unreported volumes of spoil removed, and files lacking job completion notices. Therefore, the volumes presented in this report represent minimum figures.

Approximately 10 percent of all dredging on the American side of Lake Ontario is permit dredging. From 1963 to 1972, such projects resulted in the removal of about 480,000 cubic yards of spoil from the lake (Table 5). On the average, about 48,000 cubic yards of material are dredged from Lake Ontario ports by permittees each year. The volumes removed ranged from a low of only 3,000 cubic yards in 1968 to a high of 268,000 cubic yards in 1971. No apparent pattern has been established in the past decade.

Canadian Dredging History in Lake Ontario

Dredging data for Canadian harbors on Lake Ontario have been collected and presented in Table 6. Since 1961, almost 5.5 million cubic yards of spoil has been removed in maintaining Canadian channels on the lake

Table 5. PRIVATE DREDGING IN LAKE ONTARIO, 1963-1972 (47)
(cubic yards)

| Year | Total volume |
|---|---|
| 1972 | 40,093 |
| 1971 | 268,395 |
| 1970 | 62,100 |
| 1969 | 5,750 |
| 1968 | 3,080 |
| 1967 | 13,750 |
| 1966 | 18,875 |
| 1965 | 12,600 |
| 1964 | 47,770 |
| 1963 | 8,494 |
| Total | 480,907 |

Table 6. DREDGING HISTORY IN CANADIAN PROJECTS IN LAKE ONTARIO, 1961-1972 (48, 49)
(cubic yards)

| Year | Maintenance | New work | Permit |
|---|---|---|---|
| 1972 | 48,031 | 0 | 3,023,000 |
| 1971 | 29,032 | 0 | 1,130,500 |
| 1970 | 51,221 | 0 | 25 |
| 1969 | 52,251 | 0 | 15 |
| 1968 | 100,100 | 0 | 2,000 |
| 1967 | 686,453 | 0 | N.A. |
| 1966 | 523,610 | 0 | N.A. |
| 1965 | 216,505 | 0 | N.A. |
| 1964 | 499,938 | 0 | N.A. |
| 1963 | 1,500,819 | 1,612,925 | N.A. |
| 1962 | 667,864 | 248,000 | N.A. |
| 1961 | 1,059,383 | 4,088 | N.A. |
| Total | 5,435,207 | 1,865,013 | 4,155,540 |

N.A. Data not available.

(Figure 3). The volume removed ranged from a low of 29,000 cubic yards in 1971 to a high of 1.5 million cubic yards in 1963. However, volumes have significantly decreased in the 1970's.

New work (capital) dredging in Canadian projects of Lake Ontario was most important during the early 1960's. Adjustments in harbors and waterways were made for accommodation of deeper drafts generated by completion of the St. Lawrence Seaway. Most new work dredging occurred in 1963, when approximately 1.6 million cubic yards were removed. The largest new work projects in that year were dredged at Port Credit and Toronto, where one million cubic yards and 549,000 cubic yards were removed respectively.

Although data on historical private dredging are particularly sketchy for Canadian harbors, statistics for Lake Ontario were complete from 1968 to 1972. During that period, about 4 million cubic yards of material were removed by permittees. Since the sample period is short, no reliable pattern of permit dredging activity for Canadian Lake Ontario is discernible.

In terms of volume, the most significant maintenance dredging projects on the Canadian side of Lake Ontario have historically been at Toronto, Hamilton, Oshawa, Port Credit, and Cobourg (Table 7). Each of these harbors average at least 20,000 cubic yards of maintenance dredging annually. The volume leader, of course, is Toronto, with an average of approximately 250,000 cubic yards per year.

## Projections of Future Dredging Volumes on the United States Side

### Maintenance--

Estimations of the volume of material to be removed from Lake Ontario in maintenance dredging in the next decade have become possible based on knowledge gained through this research project. Three projections are

Table 7. HISTORICAL DREDGING: CANADIAN PROJECTS IN LAKE ONTARIO, 1961-1970 (48)
(cubic yards)

| Project | Total maintenance | Total new work |
|---|---|---|
| Toronto | 2,521,940 | 549,000 |
| Oshawa | 475,391 | 63,925 |
| Port Credit | 347,000 | 1,048,000 |
| Cobourg | 238,146 | 0 |
| Hamilton | 1,524,079[a] | 200,000 |
| Port Hope | 195,332 | 0 |
| Cataraqui Bay | 56,256 | 4,088 |
| Total | 5,358,144 | 1,865,013 |

[a]Includes 155,615 cubic yards for Burlington.

determined:

(1) a figure based on C.E. estimates made in 1968 (3),

(2) a figure based on relatively recent environmental effects on dredging in the Great Lakes, and

(3) a median figure projected in this report.

The latter will be based primarily on the dredging histories of the various projects in Lake Ontario and on developments anticipated in the near future, i.e., a drop in the present high lake levels, completion of confined disposal sites, and easing of present environmental constraints. Changes in shipping needs in the next decade and the potential of year-round navigation are not expected to affect dredging in Lake Ontario in the next 10 years.

In 1968, the C.E. projected dredging volumes in the major harbors and waterways of Lake Ontario, i.e., Rochester and Oswego (3). Where projections were not provided in 1968, data on annual average maintenance

dredging have been provided by the C.E. in 1973. Utilizing these data, it is projected that approximately 3.7 million cubic yards of material will be removed from U.S. projects in Lake Ontario in the next decade (Table 8). Based on other projections of Lake Ontario, this figure represents a high estimate.

In the past few years, certain environmental policies (Section V) have occurred which may cause dredging volumes in Lake Ontario to decline in the next decade, particularly on the American side. It is generally felt by most environmental interests, that polluted spoil should be confined. Approximately 92 percent of the dredgings removed from U.S. projects of Lake Ontario are classed as polluted by the E.P.A. Confined disposal sites have been in use at major harbors in the Great Lakes for some time, but many more sites are necessary if polluted spoil is to be confined. Such sites are in various stages of development, from planning to actual construction. If a sufficient number of confined disposal

Table 8. C.E. PROJECTIONS AND ANNUAL MAINTENANCE DREDGING VOLUMES, LAKE ONTARIO (3, 47)
(cubic yards)

| Project | Average annual dredging, 1960-1968 | Projection, 1969 |
|---|---|---|
| Great Sodus | 35,686 | 8,000[a] |
| Little Sodus | 18,724 | 8,000[a] |
| Oswego | 64,000 | 64,000 |
| Rochester | 264,000 | 288,000 |
| Wilson | 1,423 | 1,600[a] |
| Olcott | 3,174 | 1,600[a] |
| Total | | 371,000 |

[a]Reported as average annual dredging by the C.E. in 1970; used as projections for these smaller harbors.

sites become available, then dredging volumes may increase in the next decade. However, difficulty is being experienced in some areas for finding and developing suitable sites which are mutually agreeable to all concerned groups. In some cases, the cost to local parties is considered too great. Unless waivers of costs to local groups are obtained, site agreements are reached, and/or the E.P.A. modifies its pollution criteria, dredging at many harbors in the future may decline to some extent. In the interest of the regional and national economy, most major harbors and waterways will probably be dredged at any environmental cost, even if at a reduced scale. However, the smaller and more marginal commercial projects and all recreational and harbors of refuge would probably be downgraded. Thus, under these considerations, a lower figure for the C.E.'s dredging volume in Lake Ontario in the next decade is about 2.2 million cubic yards. This figure represents a decline in dredging volumes of approximately one standard deviation from the norm in the past decade.

Based primarily on the dredging history of Lake Ontario, a median estimate of the volume of material to be removed in the next decade is possible. The decade of the 1960's, i.e., 1960 to 1970, has been chosen as typical for the purposes of this project. The St. Lawrence Seaway was completed in 1959, and only in recent years higher than average lake levels and the E.P.A. constraints have had effects on dredging. In estimating future volumes then, the frequency at which individual projects were dredged during the 1960's has been utilized. Some harbors and waterways are dredged annually while others are maintained relatively infrequently (Table 9).

Between 1961 and 1970 the C.E. dredged only one of 5 projects every year in Lake Erie: the average per year was 3. During that decade the volume of material removed each year ranged from 188,000 cubic yards to 568,000 cubic yards: the average was 364,000 cubic yards per year. No significant correlation exists between number of jobs completed per year

Table 9. FREQUENCY OF DREDGING BY THE C.E., LAKE ONTARIO PROJECTS, 1961-1970 (47)

| Project | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 |
|---|---|---|---|---|---|---|---|---|---|---|
| Great Sodus | x | x | x | x | x | x | x | | x | |
| Little Sodus | | | | x | x | | | x | x | |
| Oswego | x | x | x | x | | x | x | | x | |
| Rochester | x | x | x | x | x | x | x | x | x | x |
| Wilson | | x | | | | | | | | |
| Olcott | | x | | | | | | | | |
| Total projects per year | 3 | 5 | 3 | 4 | 3 | 3 | 3 | 2 | 4 | 1 |

and the volume of spoil removed. Six projects were maintained on Lake Ontario between 1961 and 1970. Only Rochester was dredged a total of at least one million cubic yards of material during that time (Table 10). If the probable fall in lake levels actually occurs in the near future, if environmental constraints are relaxed in consideration of economics in the Great Lakes region, and/or if confined disposal sites under consideration at present actually become available, then dredging in the next decade may be slightly higher than normal. Volumes would be above average for a few years to allow for the removal of material which has accumulated during the past 3 years, a period of relatively lower than normal dredging activity. A return to average dredging volumes would probably occur within 3 or 4 years thereafter. Thus, a median estimate of the total volume of U.S. maintenance dredging in the next decade is approximately 3.6 million cubic yards of material. This figure, only slightly lower than the C.E. projection of 3.7 million for Lake Ontario, should be considered the projection provided by this report.

Table 10. FREQUENCY OF DREDGING AND VOLUME OF SPOIL REMOVED BY THE C.E., 1961-1970 (47)
(cubic yards)

| Project | Frequency dredged, 1961-1970 | Maintenance volume |
|---|---|---|
| Great Sodus | 8 | 237,630 |
| Little Sodus | 4 | 150,747 |
| Oswego | 7 | 546,830 |
| Rochester | 10 | 2,670,289 |
| Wilson | 1 | 9,484 |
| Olcott | 1 | 21,157 |
| Total | | 3,636,137 |

Permit--

If permit dredging activity in the past decade can be considered typical of Lake Ontario, and if recent dredging cutbacks are balanced by greater volumes removed after disposal sites become available in the next few years, then it is estimated that a total of 300,000 cubic yards of material will be removed by permittees in the next decade. This projection, however, is based on minimal data. Dredging in some years may show many small volume permits approved, and the total may be significantly less than the projection. In other years, only a few permits may be approved, but because the jobs are large, volumes may be considerably greater than the projection posed herein.

Future New Work by the Corps of Engineers in Lake Ontario

Only Oak Orchard Harbor is scheduled for new work dredging in Lake Ontario in the next 10 years. The total amount of material to be

removed is 61,000 cubic yards. However, actual completion of the project may be considered to be only reasonably certain. In fact, the possibility exists that any project presently scheduled may never develop beyond the planning stage. Completion of new work dredging is particularly difficult to determine due to economic and environmental feasibility factors. Money allocations and environmental impact must be appraised before any future new work projects are actually accomplished. Projects considered important at present may be delayed and even cancelled because they lose significance during processes of approval by various governmental agencies and other interest groups.

## Projections of Canadian Dredging Volumes

### Maintenance--

In the decade 1961 to 1970, a range of 2 to 7 maintenance dredging projects occurred annually in Canadian waters of Lake Ontario. The average annual number of jobs per year was 5. The total volume of material removed ranged from about 51,000 cubic yards to 1.5 million cubic yards: the average annual volume removed in that decade was 536,000 cubic yards (Table 11).

In terms of future spoil removal on the Canadian side of Lake Ontario, projections of maintenance dredging volumes from 1973 to 1977 were made available by the D.P.W. A total of approximately 435,000 cubic yards of spoil are scheduled to be dredged in maintaining Canadian harbors on Lake Ontario in the next 3 to 4 years (Table 12). Approximately half of the total in this time is expected to be removed from the harbor at Toronto.

Obviously, Canadian projections for maintenance dredging in the near future are lower than the average dredging volumes which occurred during the 1960's. However, expansion in the Toronto Harbor, involving about 8 million cubic yards of new work dredging, is expected to be completed

Table 11. CANADIAN DREDGING FREQUENCIES, LAKE ONTARIO PROJECTS, 1961-1970 (48)

| Project | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 |
|---|---|---|---|---|---|---|---|---|---|---|
| Toronto | x | x | x | x | x | x | x | x | | x |
| Oshawa | x | x | | x | x | x | x | x | | |
| Port Credit | x | | x | | | | | | | |
| Burlington | | | | x | | | | | | |
| Cobourg | x | x | x | x | | x | x | | x | x |
| Hamilton | x | x | x | x | | x | x | x | x | x |
| Port Hope | x | x | x | x | x | x | x | x | | x |
| Cataraqui | x | | | | | | | | | |
| Total projects per year | 7 | 5 | 5 | 6 | 3 | 5 | 5 | 4 | 2 | 4 |

Table 12. FUTURE DREDGING IN CANADA 1973-1977, LAKE ONTARIO (cubic yards) (48)

| | Volume |
|---|---|
| Maintenance projects | |
| Bronte | 15,000 |
| Cobourg | 50,000 |
| Oshawa | 140,000 |
| Whitby | 10,000 |
| Toronto | 220,000 |
| Total maintenance volume | 435,000 |
| Private projects | |
| Port Weller (by S.L.S.A.) | 85,000 |
| Bowmanville (by Ontario Hydro) | 221,000 |
| Total private volume | 306,000 |
| New work projects | |
| Toronto | 8,010,000 |
| Total new work volume | 8,010,000 |

within two years. This will increase maintenance dredging somewhat after 1975. Thus, considering Canadian projections primarily, it is estimated that an average of 500,000 cubic yards of material will be removed from the Canadian side of Lake Ontario every year for the next decade in maintenance dredging projects.

Private--

Permit dredging has fluctuated widely in terms of volumes on the Canadian side of Lake Ontario in recent years. More than 4 million cubic yards were removed by permit since 1968. In some years very little permit dredging activity has occurred. However, other projects have resulted in the removal of hundreds of thousands of cubic yards of spoil. Canadian data reveal that at least 306,000 cubic yards of spoil are already scheduled to be removed by private interests in Lake Ontario projects by 1977 (Table 12). Thus, in an attempt to generalize a projection on permit dredging in Canadian waters of Lake Ontario, it is postulated that an average of 100,000 cubic yards of material will be removed by permit every year in the next decade.

New Work--

In the decade of the 1960's about 1.9 million cubic yards of material were dredged in Canadian new work projects in Lake Ontario. All new work in the lake occurred in the early 1960's; none has occurred since 1963. In the research for this project, only one capital dredging project was projected by any Canadian authorities for Lake Ontario. At Toronto, port expansion is expected to result in the removal of approximately 8 million cubic yards of spoil by 1975. No other new work projects are scheduled for Canadian harbors on Lake Ontario.

Summary

The total volume of maintenance and permit dredging to occur in Lake

Ontario to 1983 is estimated to be almost 1.0 million cubic yards per year (Table 13). About 60 percent will occur on the Canadian side and 40 percent on the American side. Since most confined disposal sites planned for American projects in Lake Ontario will not be completed until 1975, 1976, or 1977, American volumes in the next few years will remain relatively low. However, after confined sites are ready to receive polluted spoil, all dredging activities may increase. By 1983 the average volumes being removed from Lake Ontario should be similar to those which were removed during the decade of the 1960's.

Table 13. ESTIMATES OF FUTURE AVERAGE ANNUAL DREDGING VOLUMES IN LAKE ONTARIO
(cubic yards)

| | U.S. projects | | Canadian projects |
|---|---|---|---|
| Maintenance | 360,000 | | 500,000 |
| Permit | 30,000 | | 100,000 |
| Annual total | 390,000 | | 600,000 |
| Total for Lake Ontario | | 990,000 | |
| Future new work | 61,000 | | 8,100,000 |

## DREDGING QUANTITIES IN LAKE ERIE

More dredging occurs in Lake Erie (including the Detroit and Rouge Rivers) than in any other part of the Great Lakes. High dredging volumes here are generated primarily at large commercial projects such as Buffalo, Cleveland, Toledo, and the Detroit River. In addition to maintaining these and other smaller commercial harbors, a few recreational and harbors of refuge on the lake are dredged. Twenty-one U.S. projects and 15 Canadian harbors in Lake Erie require dredging, at least periodically (Figur 4).

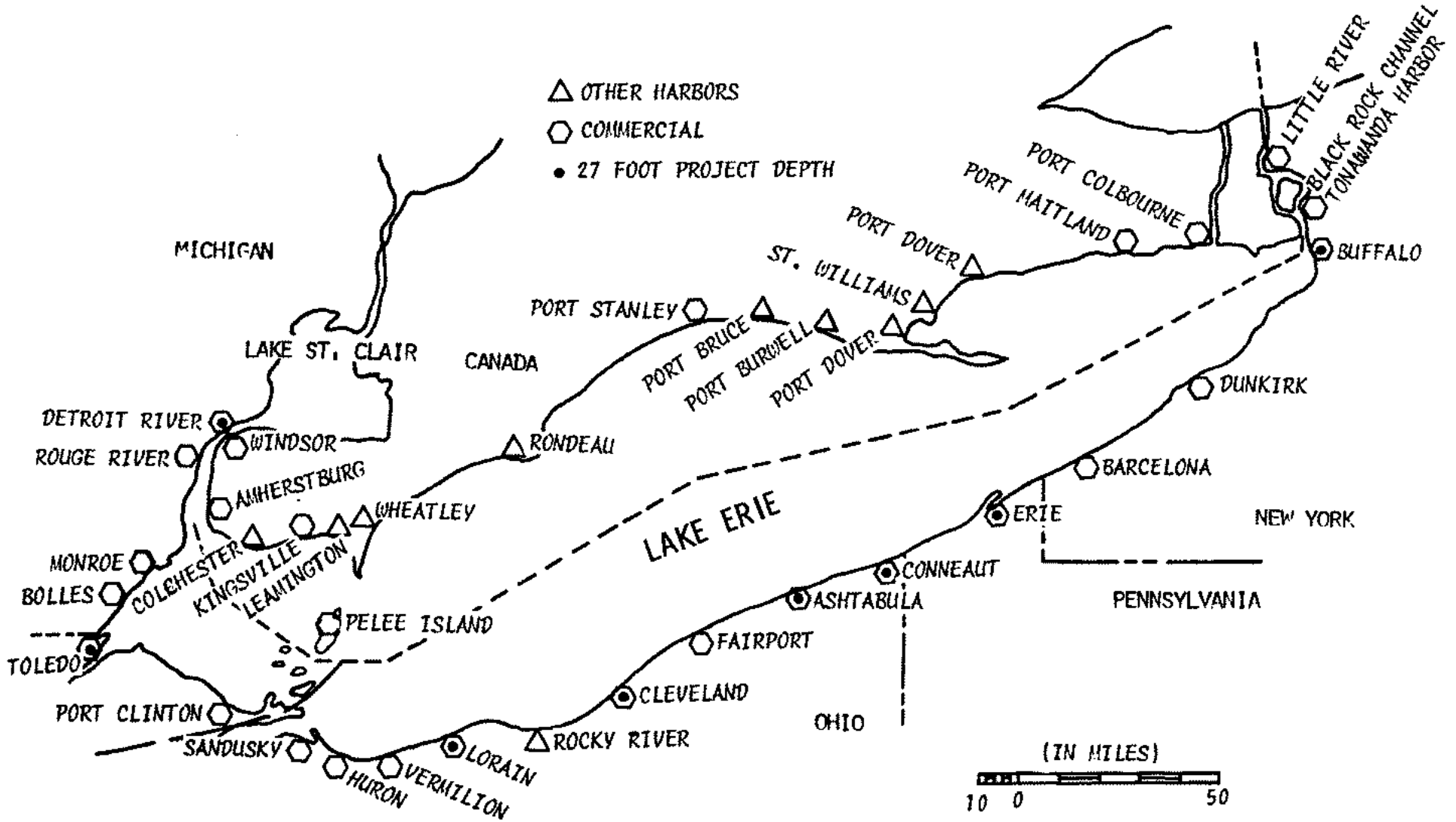



Figure 4. PRINCIPAL DREDGING PROJECTS IN LAKE ERIE

Average annual commerce at 14 American harbors is substantial enough so that the cost of their maintenance is classed as unequivocally justified by the C.E. (2). In fact, 8 American harbors and waterways on Lake Erie are dredged to maintain the 27-foot St. Lawrence Seaway channel depth (Figure 4). Other harbors with less commercial traffic, i.e., those with lower benefit/cost ratios, have continually been dredged in the past. However, reductions in money allocations or port status changes may cause cessation of dredging operations at the more marginal harbors such as Dunkirk, Barcelona, or Rocky River.

In terms of volume, the most important American maintenance dredging projects in Lake Erie are at Toledo, Cleveland, Buffalo, and Sandusky. All of these require removal of more than 400,000 cubic yards of spoil annually (Figure 5). Of the Canadian harbors, the volume leader has been Port Burwell, which averaged approximately 180,000 cubic yards per year until recently. However, a status change has occurred at Port Burwell, resulting in a reduction in project depth from 22 feet to 10 feet. Port Stanley, with an average of less than 90,000 cubic yards of spoil removed each year, is now the most important dredging project on Lake Erie. No Canadian harbor on the lake is dredged to the 27-foot St. Lawrence Seaway depth.

## United States Dredging History in Lake Erie

Lake Erie has been dredged for decades, but complete, meaningful, and comparable volume data for C.E. projects are available only from 1951. Prior to that time, records on actual volumes dredged become sketchy to non-existent for some harbors, even in C.E. Annual Reports. In many cases, dollar cost figures were reported in lieu of spoil volumes. Because of differences in types of material being removed, types of dredging operations, and in value of the dollar over time, accurate conversion of cost figures to volume figures was not possible for many of

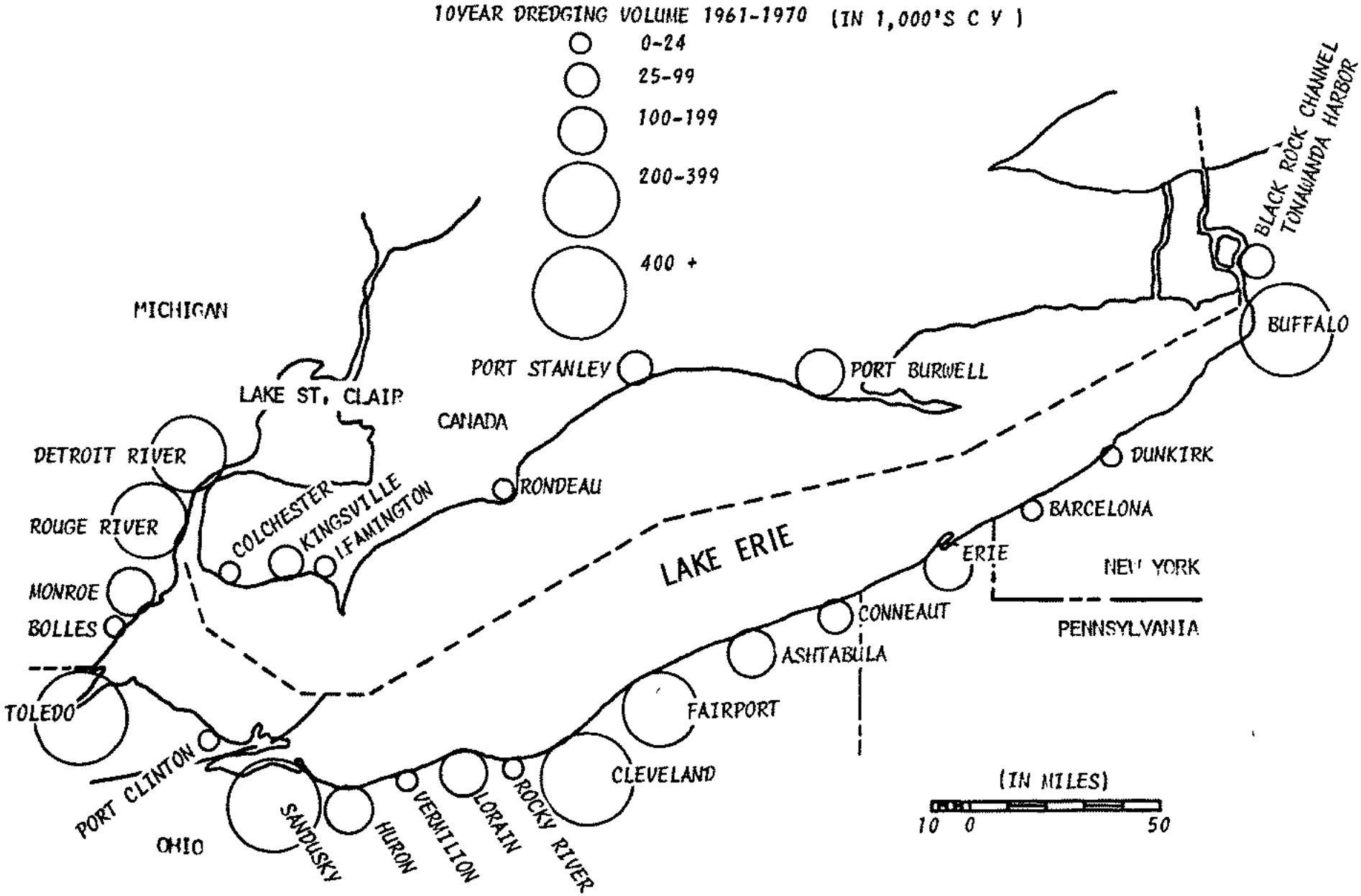



Figure 5. AVERAGE ANNUAL MAINTENANCE DREDGING VOLUMES IN LAKE ERIE, 1961-1970

those earlier years. However, complete and meaningful maintenance and new work dredging data since 1951 were collected and are presented in Table 14.

Since 1951, approximately 134 million cubic yards of spoil has been removed from Lake Erie and the Detroit and Rouge Rivers by the C.E. About 56 percent has been derived from Buffalo District projects and 44 percent from Detroit District projects. Seventy percent of the total volume involved was removed in maintenance dredging and 30 percent in new work projects. Of all material removed in maintenance projects since 1951, more than three-fifths came from Toledo, Cleveland, Buffalo, and Sandusky combined. Most new work dredging quantities during the same period were extracted from the Detroit River, Toledo, and Buffalo.

Maintenance Dredging--

In the past decade, maintenance dredging has accounted for approximately 55 percent of all dredging on the American side of Lake Erie. In terms of volume removed over a longer period, i.e., 1951 to 1972, the Buffalo District C.E. dredged an average of 2.64 million cubic yards of spoil from Lake Erie projects annually in maintenance projects. Absolute amounts for the Buffalo District ranged from a low of 1.98 million cubic yards in 1954 to a high of 3.89 million cubic yards in 1967 (Table 15). In the same period the Detroit District C.E. dredged an average of 1.60 million cubic yards of material annually from Lake Erie projects including the Detroit and Rouge Rivers. Absolute amounts for the Detroit District ranged from a low of 0.87 million cubic yards in 1963 to a high of 3.28 million cubic yards in 1968. Thus, an average of 4.23 million cubic yards of spoil has been removed in maintaining projects in Lake Erie every year from 1951 to 1972. The range was from a low of 3.14 million cubic yards in 1953 to a high of 6.52 million yards in 1967 (Figure 6). A relatively consistent volume of spoil has been dredged from Lake Erie in recent decades. Since 1951, the Buffalo District C.E.

Table 14. HISTORICAL DREDGING IN LAKE ERIE BY HARBOR/WATERWAY AND C.E. DISTRICT, 1951-1972 (47, 50)
(cubic yards)

| Harbor/Waterway | Maintenance | New work | Total |
|---|---|---|---|
| Buffalo District | | | |
| Ashtabula | 2,817,792 | 2,584,469 | 5,402,261 |
| Black Rock Channel and Tonawanda Harbor | 1,342,475 | 122,511 | 1,464,986 |
| Buffalo | 9,561,490 | 6,640,455 | 16,201,945 |
| Cleveland | 19,065,831 | 2,709,006 | 21,774,837 |
| Conneaut | 1,560,227 | 1,437,458 | 2,997,685 |
| Dunkirk | 333,320 | 195,166 | 528,486 |
| Erie | 2,990,890 | 656,715 | 3,647,605 |
| Fairport | 6,534,780 | 11,666 | 6,546,446 |
| Huron | 3,236,320 | 0 | 3,236,320 |
| Lorain | 3,791,160 | 1,327,271 | 5,118,431 |
| Rocky River | 7,083 | 0 | 7,083 |
| Sandusky | 7,090,207 | 1,253,936 | 8,344,143 |
| Totals | 58,331,575 | 16,938,653 | 75,270,228 |
| Detroit District | | | |
| Bolles | 87,371 | 157,898 | 245,269 |
| Detroit River | 5,396,005 | 12,273,460 | 17,669,465 |
| Monroe | 4,475,423 | 0 | 4,475,423 |
| Port Clinton | 57,934 | 0 | 57,934 |
| Rouge River | 4,493,577 | 0 | 4,493,577 |
| Toledo | 20,789,930 | 11,411,931 | 32,201,861 |
| Totals | 35,300,240 | 23,843,289 | 59,143,529 |
| Grand totals | 93,631,815 | 40,781,942 | 134,413,757 |

Table 15. ANNUAL MAINTENANCE DREDGING IN LAKE ERIE, 1951-1972 (47, 50)
(cubic yards)

| Year | Buffalo District | Detroit District | Total Volume |
|---|---|---|---|
| 1972 | 2,112,555 | 1,366,336 | 3,478,891 |
| 1971 | 2,321,135 | 1,080,472 | 3,401,607 |
| 1970 | 2,478,930 | 1,804,690 | 4,283,620 |
| 1969 | 2,996,703 | 2,396,727 | 5,393,430 |
| 1968 | 2,869,449 | 3,278,175 | 6,147,624 |
| 1967 | 3,892,150 | 2,636,984 | 6,529,134 |
| 1966 | 2,784,952 | 1,693,665 | 4,478,617 |
| 1965 | 2,141,659 | 1,636,712 | 3,778,371 |
| 1964 | 2,739,205 | 707,539 | 3,446,744 |
| 1963 | 2,799,863 | 874,275 | 3,674,138 |
| 1962 | 2,636,714 | 943,132 | 3,579,846 |
| 1961 | 3,053,721 | 2,126,050 | 5,179,771 |
| 1960 | 2,911,955 | 2,586,735 | 5,498,890 |
| 1959 | 3,097,801 | 1,648,815 | 4,746,616 |
| 1958 | 2,942,716 | 1,675,957 | 4,618,673 |
| 1957 | 2,880,035 | 1,437,262 | 4,317,297 |
| 1956 | 2,178,527 | 1,129,870 | 3,308,397 |
| 1955 | 2,195,340 | 1,424,229 | 3,619,569 |
| 1954 | 1,980,695 | 1,596,869 | 3,577,564 |
| 1953 | 2,082,365 | 1,062,251 | 3,144,616 |
| 1952 | 2,938,146 | 874,808 | 3,812,954 |
| 1951 | 2,296,959 | 1,318,687 | 3,615,646 |
| Totals | 58,331,575 | 35,300,240 | 93,631,815 |

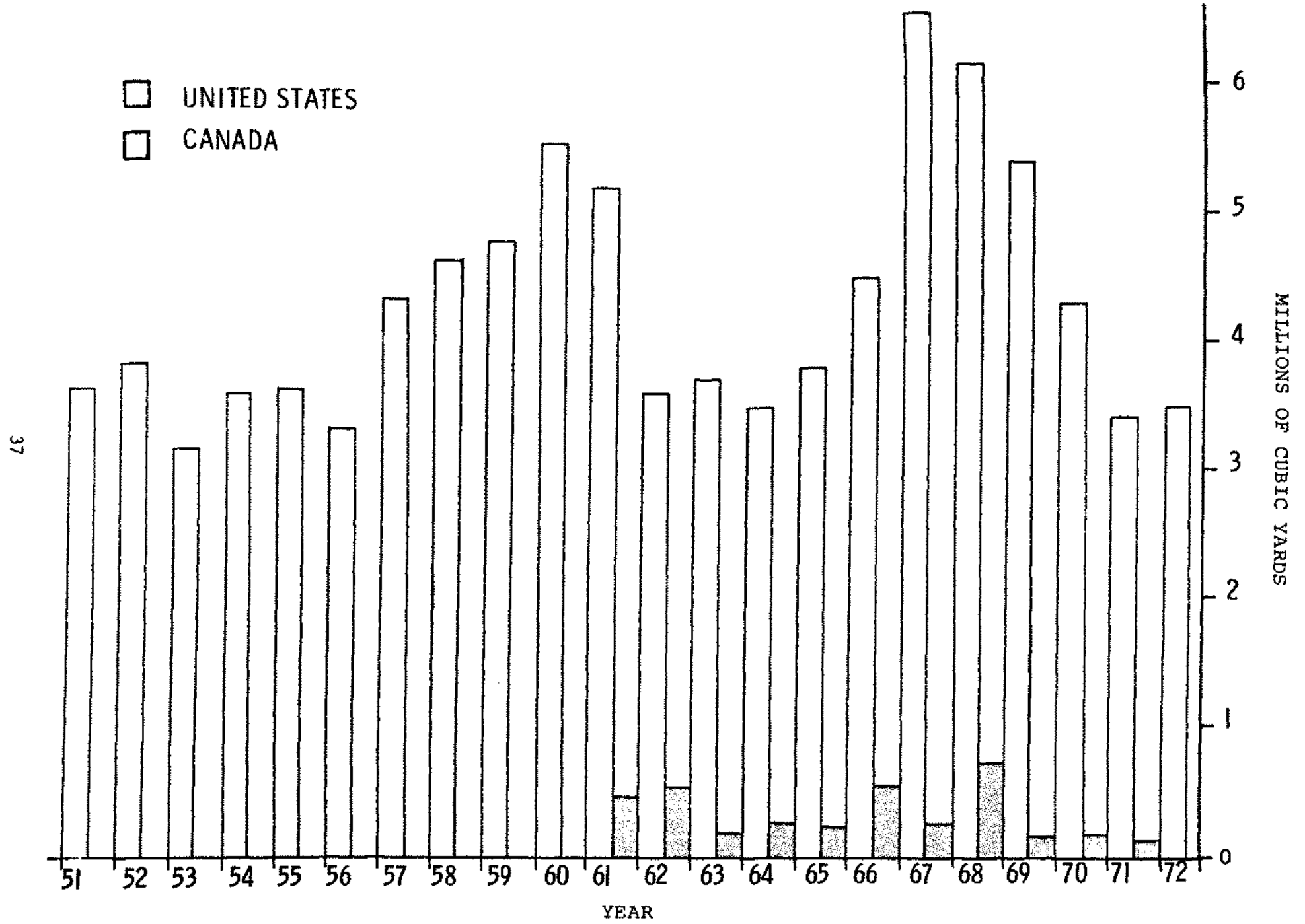



Figure 6. MAINTENANCE DREDGING VOLUMES IN LAKE ERIE, 1951-1972

has been responsible for removing more than 58 million cubic yards of spoil and the Detroit District approximately 35 million cubic yards.

New Work Dredging--

In the past decade, new work has accounted for approximately 35 percent of all dredging activity on the American side of Lake Erie. Over the longer term, i.e., 1951 to 1972, more than 40 million cubic yards of spoil was removed in new work projects. However, unlike average maintenance volumes, new work volume totals display very little regularity from year to year. New work volumes range from a low of no new work in 1971 and 1972 to a high of more than 12 million cubic yards in 1963 (Table 16). During the late 1950's and the early 1960's new work dredging became highly important. In fact, more than 90 percent of the new work dredging in Lake Erie waters since 1951 occurred between 1958 and 1967. For the most part, this was due to the deepening and widening of harbors and waterways to accommodate commerce generated by the St. Lawrence Seaway, which was completed in 1959.

The largest new work project in Lake Erie since 1951 occurred at Toledo. In 1963 almost 7 million cubic yards of spoil were dredged in that project. Of all new work dredging since 1951, 58 percent occurred in Detroit District C.E. projects and 42 percent in Buffalo District projects.

Permit Dredging--

Dredging by non-federal interests may only be undertaken when authorization of the C.E. is obtained through permits. Permit dredging data in Lake Erie has been traced thoroughly from 1963 to the present. Data were gathered from C.E. in Buffalo and Detroit, from the E.P.A. in Chicago, and from New York State Department of Environmental Conservation in Albany. This compilation of permit dredging volume data is as complete as possible, considering certain restrictions such as missing

Table 16. NEW WORK DREDGING IN LAKE ERIE, 1951-1972 (47, 50)
(cubic yards)

| Year | Buffalo District | Detroit District | Total |
|---|---|---|---|
| 1972 | 0 | 0 | 0 |
| 1971 | 0 | 0 | 0 |
| 1970 | 86,836 | 51,449 | 138,285 |
| 1969 | 0 | 46,464 | 46,464 |
| 1968 | 387,466 | 0 | 387,466 |
| 1967 | 1,150,721 | 79,854 | 1,230,575 |
| 1966 | 3,186,485 | 399,467 | 3,585,952 |
| 1965 | 2,441,336 | 1,297,268 | 3,738,604 |
| 1964 | 1,361,080 | 3,103,642 | 4,464,722 |
| 1963 | 3,239,048 | 9,494,166 | 12,733,214 |
| 1962 | 491,966 | 2,015,771 | 2,507,737[a] |
| 1961 | 294,663 | 3,499,913 | 3,794,576 |
| 1960 | 1,167,686 | 906,416 | 2,074,102 |
| 1959 | 736,545 | 1,284,498 | 2,021,043 |
| 1958 | 0 | 1,664,381 | 1,664,381 |
| 1957 | 395,503 | 0 | 395,503 |
| 1956 | 720,000 | 0 | 720,000 |
| 1955 | 250,000 | 0 | 250,000 |
| 1954 | 227,083 | 0 | 227,083 |
| 1953 | 193,750 | 0 | 193,750 |
| 1952 | 291,958 | 0 | 291,958 |
| 1951 | 316,527 | 0 | 316,527 |
| Totals | 16,938,653 | 23,843,289 | 40,781,941 |

[a]Plus two more jobs of unreported and unknown quantity.

permit files, unreported volumes of spoil removed, and files lacking job completion notices. Compilation of complete and comparable volume data for permit dredging prior to 1963 is actually impossible in Lake Erie projects for such reasons. Therefore, the private dredging volumes presented in this report represent minimum figures.

Approximately 10 percent of all U.S. dredging in Lake Erie is permit dredging. From 1963 to 1972, such projects resulted in the removal of more than 8 million cubic yards of spoil from the lake (Table 17). On the average, approximately 800,000 cubic yards of material are dredged from the lake by permittees each year. The volumes removed ranged from a low of 156,000 cubic yards in 1968 to a high of 2.2 million cubic yards in 1970. No apparent pattern has been established in the past decade. Of all permit dredging, 80 percent of the volume is removed under the jurisdiction of the Detroit District C.E. and 20 percent under the Buffalo District.

Table 17. PRIVATE DREDGING IN LAKE ERIE, 1963-1972 (47, 50)
(cubic yards)

| Year | Buffalo District | Detroit District | Total |
|---|---|---|---|
| 1972 | 71,484 | 409,000 | 480,484 |
| 1971 | 141,774 | 393,499 | 535,273 |
| 1970 | 213,637 | 2,010,000 | 2,223,637 |
| 1969 | 130,858 | 435,067 | 565,925 |
| 1968 | 106,660 | 49,800 | 156,460 |
| 1967 | 160,512 | 478,860 | 639,372 |
| 1966 | 163,660 | 868,010 | 1,031,670 |
| 1965 | 60,765 | 624,845 | 685,610 |
| 1964 | 277,641 | 795,902 | 1,073,543 |
| 1963 | 254,190 | 471,719 | 725,909 |
| Totals | 1,581,181 | 6,536,702 | 8,117,883 |

## Canadian Dredging History in Lake Erie

Dredging data for Canadian harbors on Lake Erie have been collected and collated from 1961 to the present (Figure 6). In those 11 years, more than 3.5 million cubic yards of spoil has been removed in maintaining several comparatively small Canadian harbors. Amounts of material removed ranged from a low of about 120,000 cubic yards in 1971 to a high of approximately 710,000 cubic yards in 1968 (Table 18). Essentially no new work dredging has been done on the Canadian side of Lake Erie for more than a decade.

Data on permit dredging are particularly sketchy for Canadian harbors since statistics for Lake Erie were available only from 1969 to 1972. In that period, an approximate total of a one-half million cubic yards of spoil were removed by permittees. Because the sample period is short, no pattern of permit dredging activity for Canadian Lake Erie can be determined.

In terms of volume, the most significant Canadian maintenance dredging projects have historically been at Port Burwell, Port Stanley, Kingsville, and Leamington (Table 19). With the recent phasing out of Port Burwell as a coal port, dredging there has ceased. Port Stanley has become the volume leader with an average of only about 90,000 cubic yards per year.

## Projections of Future Dredging Quantities on the United States Side

### Maintenance—

Estimations of the quantities of material to be removed from Lake Erie in maintenance dredging in the next decade is possible based on the information available. Three projections will be provided, as follows:

(1) a figure based on C.E. estimates made in 1968 (3,4).

(2) a figure based on relatively recent environmental effects on

Table 18. DREDGING HISTORY IN CANADIAN PROJECTS IN LAKE ERIE, 1961-1972 (47, 50)
(cubic yards)

| Year | Maintenance | New work | Permit |
|---|---|---|---|
| 1972 | N.A. | 0 | 5,800 |
| 1971 | 119,789 | 0 | 430,000 |
| 1970 | 171,753 | 0 | 500 |
| 1969 | 157,233 | 0 | 2,000 |
| 1968 | 710,791 | 0 | N.A. |
| 1967 | 247,831 | 0 | N.A. |
| 1966 | 535,982 | 10 | N.A. |
| 1965 | 236,877 | 0 | N.A. |
| 1964 | 287,226 | 0 | N.A. |
| 1963 | 199,825 | 0 | N.A. |
| 1962 | 512,946 | 0 | N.A. |
| 1961 | 466,026 | 0 | N.A. |
| Totals | 3,619,847 | 10 | 438,300 |

N.A. Data not available.

Table 19. HISTORICAL DREDGING: CANADIAN PROJECTS IN LAKE ERIE, 1961-1970 (48)
(cubic yards)

| Project | Total maintenance | Total new work |
|---|---|---|
| Kingsville | 258,434 | 0 |
| Pelee Island | 15,092 | 0 |
| Port Dover | 32,035 | 0 |
| Port Maitland | 51,692 | 0 |
| Port Stanley | 865,646 | 0 |
| Amherstburg | 6,365 | 10 |
| Leamington | 207,808 | 0 |
| Port Burwell | 1,827,159 | 0 |
| St. Williams | 3,867 | 0 |
| Wheatley | 69,918 | 0 |
| Rondeau | 135,172 | 0 |
| Windsor | 1,023 | 0 |
| Colchester | 11,974 | 0 |
| Port Bruce | 300 | 0 |
| Port Rowan | 13,573 | 0 |
| Totals | 3,500,058 | 10 |

dredging in the Great Lakes, and

(3) a median figure projected in this report.

The latter will be based primarily on the past dredging histories in Lake Erie and on developments expected in the near future, i.e., a drop in the present high lake levels, completion of confined disposal sites, and easing of present environmental constraints. Changes in shipping needs in the next decade and the potential of year-round navigation are not expected to affect dredging significantly in Lake Erie.

In 1968 the C.E. projected dredging volumes for most of the major harbors and waterways of Lake Erie (3,4). For a few harbors for which projections were not provided, data on annual average maintenance dredging have been made available by the Buffalo District. Utilizing these data, it is projected that approximately 5.4 million cubic yards of material will be removed annually from American waters of Lake Erie in the next decade (Table 20). This figure is a high estimate compared to other projections in this subsection.

In the past few years, environmental policies have developed which may cause dredging volumes in Lake Erie to decline somewhat in the next decade. It is generally felt by most environmental interests that polluted spoil should be confined. Approximately 95 percent of the material removed from U.S. projects in Lake Erie is classed as polluted by the E.P.A. Confined disposal sites have been in use at high volume such as Buffalo, Cleveland, Toledo, and the Detroit River for some time, but many more sites are necessary. Such sites are in various stages of development, from selection and planning to actual construction. If a sufficient number of confined disposal sites become available, then dredging volumes may continue high in the next decade. However, difficulty is being experienced in some areas in finding and developing suitable sites which are mutually agreeable to all concerned agencies. In some cases, the cost to local interests may be considerable. In others, actual site selection has thus far not been agreeable to all parties.

Table 20. C.E. PROJECTIONS AND ANNUAL MAINTENANCE DREDGING VOLUMES, LAKE ERIE (3, 47, 50, 51)
(cubic yards)

| Project | Average annual dredging 1960-1968 | 1969 projection |
|---|---|---|
| Ashtabula | 104,000 | 176,000 |
| Black Rock Channel and Tonawanda Harbor | 105,776 | 80,000 |
| Buffalo | 464,800 | 420,000 |
| Cleveland | 976,000 | 976,000 |
| Conneaut | 60,000 | 80,000 |
| Dunkirk | 15,448 | 16,000 |
| Erie | 145,600 | 240,000 |
| Fairport | 296,000 | 320,000 |
| Huron | 150,000 | 160,000 |
| Lorain | 150,000 | 240,000 |
| Rocky River | 1,062 | 12,000[a] |
| Sandusky | 316,000 | 480,000 |
| Bolles | 10,921 | 20,000[a] |
| Detroit River | 640,000 | 640,000 |
| Monroe | 192,000 | 192,000 |
| Port Clinton | 4,043 | 8,000[a] |
| Rouge River | 240,000 | 240,000 |
| Toledo | 1,120,000 | 1,120,000 |
| Total | | 5,420,000 |

[a]Reported as average annual dredging by the C.E. in 1970; used as projections for these harbors.

Unless waivers of costs to local groups are obtained, site agreements are reached, and/or the E.P.A. relaxes some of its pollution criteria, maintenance dredging in the future will decline to some extent. As of July, 1974, a waiver was granted to Toledo and additional waivers are pending for Fairport, Conneaut, Cleveland, Lorain, and Ashtabula. However, polluted spoil is being dumped in the open lake in the Buffalo District. Thus, in the interest of the regional and national economy, most major harbors and waterways will probably be dredged at any environmental cost, even if at a reduced scale. But the smaller and more marginal commercial projects and many recreational and harbors of refuge would probably be eliminated entirely. Thus, under these considerations, a lower figure for the C.E. dredging volume in Lake Erie in the next decade is about 35 million cubic yards. This figure represents a decline in dredging volumes of approximately one standard deviation from the norm in the past decade.

Based primarily on the recent dredging history of Lake Erie, a median estimate of the volume of material to be removed in the next decade is possible. The decade of the 1960's, i.e., 1961 to 1970, has been chosen as typical. The St. Lawrence Seaway was completed in 1959, and in the early 1970's higher than average lake levels and E.P.A. pollution criteria have had effects on dredging. In estimating future volumes then, the frequency at which individual projects were dredged during the 1960's has been utilized. Some harbors and waterways are dredged annually while others are maintained less frequently (Table 21).

Between 1961 and 1970 the C.E. dredged 13 to 16 maintenance projects annually: the average per year was 14. During that decade, the volume of material removed each year ranged from 3.4 million cubic yards to 6.5 million cubic yards: the average was 4.6 million cubic yards annually. No significant correlation existed between number of jobs completed per year and volume of spoil removed. Eighteen projects were maintained on Lake Erie between 1961 and 1970. Twelve were dredged a total of at

Table 21. FREQUENCY OF DREDGING BY THE C.E., LAKE ERIE PROJECTS, 1961-1970 (47, 50)

| Project | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 |
|---|---|---|---|---|---|---|---|---|---|---|
| Ashtabula | x | x | x | x | x | x | x | x | x | x |
| Black Rock Channel and Tonawanda Harbor | x | x | x | x | x | x | x | x | x | x |
| Buffalo | x | x | x | x | x | x | x | x | x | x |
| Cleveland | x | x | x | x | x | x | x | x | x | x |
| Conneaut | x | x | x | x | x | | | x | x | x |
| Dunkirk | x | x | x | | | x | | | x | x |
| Erie | x | x | x | x | | x | x | x | x | x |
| Fairport | x | x | x | x | x | x | x | x | x | x |
| Huron | x | x | x | x | x | x | x | x | x | x |
| Lorain | x | x | | x | x | | x | x | x | x |
| Rocky River | | | | x | x | | | | | |
| Sandusky | x | x | x | x | x | x | x | x | x | x |
| Bolles | | | | | | | | x | | |
| Detroit River | | | | x | x | x | x | x | x | x |
| Monroe | x | x | x | x | x | x | x | | x | x |
| Port Clinton | | | | x | | | | | x | |
| Rouge River | x | x | x | x | x | x | x | x | x | x |
| Toledo | x | x | x | | x | x | x | x | x | x |
| Totals | 14 | 14 | 13 | 15 | 14 | 13 | 13 | 14 | 16 | 15 |

least one million cubic yards of material during that time (Table 22). If the probable fall in lake levels actually occurs in the near future, if pollution criteria are relaxed in consideration of economics in the Great Lakes region, and/or if confined disposal sites planned become available, then dredging in the next decade may be slightly higher than normal. Volumes would be somewhat greater than normal for a few years to allow for the removal of material which has accumulated during the past 3 years, a period of relatively lower than normal dredging activity. A return to average dredging volumes would probably occur within 3 or 4 years. Thus, a median projection of U.S. maintenance dredging in Lake Erie is approximately 4.8 million cubic yards of spoil annually.

Permit--

If permit dredging activity in the past decade can be considered typical of Lake Erie, and if recent decreases in dredging are balanced by greater volumes removed after disposal sites become available in the next few years, then it is estimated that an average of 900,000 cubic yards of material will be removed each year by permittees in the next decade. This projection may be quite low or quite high because permit dredging data, as discussed previously, are not complete. Many small-volume permits may be approved in some years, and the total may be significantly less than the projection. In other years, only a few permits may be approved. However, because the jobs are large, volumes may be considerably greater than the projection posed herein.

Future New Work by the Corps of Engineers in Lake Erie--

Nine projects are in the schedule for new work dredging in Lake Erie at this time. Combined, the total amount of material to be removed is more than 4 million cubic yards (Table 23). However, actual completion of these projects may be considered to be only reasonably certain. In fact, the possibility exists that few of the projects scheduled at present may

Table 22. FREQUENCY OF DREDGING AND VOLUME OF SPOIL REMOVED BY THE C.E. LAKE ERIE, 1961-1970 (47, 50)
(cubic yards)

| Project | Frequency dredged | Maintenance volume |
|---|---|---|
| Ashtabula | 10 | 1,257,691 |
| Black Rock Channel and Tonawanda Harbor | 10 | 834,980 |
| Buffalo | 10 | 4,488,244 |
| Cleveland | 10 | 8,756,299 |
| Conneaut | 8 | 687,035 |
| Dunkirk | 6 | 121,091 |
| Erie | 9 | 1,620,327 |
| Fairport | 10 | 3,026,874 |
| Huron | 10 | 1,519,345 |
| Lorain | 8 | 1,201,993 |
| Rocky River | 2 | 7,083 |
| Sandusky | 10 | 4,397,040 |
| Bolles | 1 | 87,371 |
| Detroit River | 7 | 3,245,073 |
| Monroe | 9 | 1,846,288 |
| Port Clinton | 2 | 59,605 |
| Rouge River | 10 | 2,021,209 |
| Toledo | 9 | 10,837,905 |
| Total | | 46,015,453 |

Table 23. FUTURE NEW WORK DREDGING IN LAKE ERIE SCHEDULED BY THE C.E. AS OF 1973 (47, 50)
(cubic yards)

| Project | Volume |
|---|---|
| Huron | 840,000 |
| Fairport | 1,100,000 |
| Lorain | 70,000 |
| Sterling State Park | 186,000 |
| Cattaraugus Creek | 140,000 |
| Kelley's Island | 2,400 |
| East Harbor (Ohio) | 478,000 |
| Ottawa River | 1,281,000 |
| West Harbor (Ohio) | 299,000 |
| Total | 4,396,400 |

never develop beyond the planning stage. Future new work dredging is particularly difficult to determine due to economic and environmental factors. Money allocations and environmental impacts must be appraised before any future new work projects are actually accomplished. Projects considered important may be delayed and even cancelled in the future because they lose significance during processes of approval by various governmental agencies and other local interest groups.

One aspect of future dredging may provide a unique situation in Lake Erie. There is a possibility that a new offshore airport complex will be constructed adjacent to Cleveland, in Lake Erie. Such an undertaking would obviously involve development of an offshore land surface. If this project expands beyond planning the stages and construction begins in the next decade, tremendous volumes of material would be needed. At least part of the construction would probably involve great quantities of dredged material from Cleveland Harbor.

## Projections of Canadian Dredging Volumes

### Maintenance--

The decade 1961 to 1970 may be considered typical of Canadian dredging for purposes of this report for the same reasons considered on the American side. In that decade, a range of 3 to 9 maintenance dredging projects occurred annually in Canadian waters of Lake Erie. The average annual number of projects per year was 6. The total dredged volume ranged from about 160,000 cubic yards to 710,000 cubic yards: the average annual volume removed in that decade was 351,000 cubic yards (Table 24).

In terms of future spoil, projections of maintenance dredging volumes to 1977 were made available by the D.P.W. of Canada. A total of approximately one-half million cubic yards of spoil are anticipated to be dredged in maintaining Canadian harbors on Lake Erie in the next 3 to 4 years. About one-half of the total is expected to be removed from Port Stanley (Table 25).

Obviously, Canadian projections for the near future are lower than the average dredging volumes which occurred during the 1960's. This is due primarily to the loss of Port Burwell volumes, which will be much lower in the future than they were during that decade. Thus, considering Canadian projections, it is anticipated that approximately 150,000 to 200,000 cubic yards of material will be removed from Lake Erie annually in maintenance dredging projects.

### Permit--

Permit dredging has fluctuated widely in terms of volumes on the Canadian side of Lake Erie in recent years. In some years very little private dredging activity has occurred. But in others, only a few jobs have resulted in the removal of hundreds of thousands of cubic yards of spoil. Thus to generalize a projection on permit dredging in Canadian

Table 24. CANADIAN DREDGING FREQUENCIES, LAKE ERIE PROJECTS, 1961-1970 (48)

| Project | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 |
|---|---|---|---|---|---|---|---|---|---|---|
| Kingsville | x | x | | x | x | x | | x | | |
| Pelee Island | | x | | | x | | | | | |
| Port Dover | | x | | | | | | | x | |
| Port Maitland | x | x | | | | | | | | |
| Port Stanley | x | x | x | x | x | x | x | x | x | x |
| Amherstburg | | | x | | | x | | | | |
| Leamington | | x | x | x | x | | | x | x | |
| Port Burwell | x | x | x | x | x | x | x | x | | x |
| St. Williams | | x | | | | | | | | |
| Wheatley | | x | | | x | x | x | | | |
| Rondeau | x | | x | | x | x | x | x | x | x |
| Windsor | x | | | | | | | | | |
| Colchester | | | | | x | | | | | |
| Port Bruce | | | | | x | | | | | |
| Port Rowan | | | | | | | | x | | |
| Total projects per year | 6 | 9 | 5 | 4 | 9 | 6 | 4 | 6 | 4 | 3 |

Table 25. FUTURE MAINTENANCE DREDGING IN CANADA 1973-1977, LAKE ERIE (cubic yards) (48)

| Project | Volume |
|---|---|
| Port Burwell | 26,400 |
| Rondeau | 55,000 |
| Amherstburg | 12,000 |
| Cedar Beach | 7,000 |
| Colchester | 9,200 |
| Kingsville | 39,000 |
| Leamington | 25,000 |
| Pelee Island | 15,000 |
| Port Bruce | 4,000 |
| Port Dover | 20,000 |
| Port Maitland | 10,000 |
| Port Rowan | 30,000 |
| Port Stanley | 250,000 |
| Wheatley | 40,000 |
| Total | 542,600 |

projects, it is postulated that an average of 100,000 cubic yards of material will be removed by permit annually in the next decade.

New Work--

In the decade of the 1960's only one new work job occurred in Canadian waters of Lake Erie, and the volume of material removed was only 10 cubic yards. No capital dredging projects are projected or anticipated by the D.P.W. or the M.O.T. for Lake Erie.

Summary

The total anticipated volume of maintenance and permit dredging in Lake Erie is estimated to be almost 6 million cubic yards per year (Table 26). About 95 percent will occur on the American side and 5 percent on the Canadian side. Since all confined disposal sites planned for the U.S. projects will not be completed until 1977, volumes in the next few years will remain relatively low. However, after disposal sites are prepared, all dredging activities are expected to increase, with volumes being relatively low.. By 1983, the average or normal volumes being removed from Lake Erie should be similar to those which were removed during the decade of the 1960's.

Table 26. ESTIMATES OF FUTURE AVERAGE ANNUAL DREDGING VOLUMES IN LAKE ERIE
(cubic yards)

| | U.S. projects | | Canadian projects |
|---|---|---|---|
| Maintenance | 4,800,000 | | 175,000 |
| Permit | 900,000 | | 100,000 |
| Annual totals | 5,700,000 | | 275,000 |
| Total for Lake Erie | | 5,975,000 | |
| Future new work | 4,400,000 | | None expected |

## DREDGING QUANTITIES IN LAKES HURON AND ST. CLAIR

The principal economic function of Lakes Huron and St. Clair is intra-lake navigation and recreation. Based on unpublished C.E. data, Saginaw is the only U.S. harbor on Lake Huron which is unequivocally justified and had over 4,000,000 short tons of commerce in 1972 (5). However, other projects which were similarly justified in 1972 are the connecting waterways of the St. Marys River (80.2 million short tons), the

St. Clair River (105.3 million short tons), and Lake St. Clair (106.4 million short tons). All remaining C.E. projects have benefit/cost ratios between 1.1 to 1 and 8.13 to 1. Many harbors, such as Port Austin and Port Sanilac, have recreational benefits or are harbors of refuge, and are difficult to justify in terms of commerce. Thus, projects of greatest concern to the C.E. and commercial marine interests are Saginaw and the connecting waterways.

Except for southeastern Michigan, the Lake Huron shoreline is not heavily industrialized and most navigation projects do not require channels at Seaway depth. The most significant dredging activities in the past have occurred at the commercial projects of Alpena, Lake St. Clair and the St. Clair River, Cheyboygan, Black River, and the St. Marys River at Sault Ste. Marie (Table 27). Most harbors on the Canadian shore are infrequently dredged, which accounts for the low volume reflected on many tables of the lake. In Ontario, 50 projects are maintained by the D.P.W. Based on the 1973 Canadian Ports and Seaway Directory, 16 of these harbors and waterways have commercial status (6). However, only 3 (Sarnia, St. Clair Cut-off, and Killarney) are maintained to the 27-foot Seaway depth. The distribution of the principal projects in Lake Huron and Lake St. Clair are illustrated on Figure 7.

Maintenance and new work dredging data of the C.E. are sufficiently complete and accurate to reconstruct past dredging activities in Lake Huron, principally from the Annual Reports of the Chief of Engineers, U.S. Army on Civil Works. In Canada, the D.P.W. furnished maintenance dredging volumes from 1951-72 and capital dredging data from 1951-72. Private dredging, volumes, which were obtained from the Navigable Waters Protection Act (NWPA) files of the M.O.T., date back to 1960.

Table 27. HISTORICAL DREDGING TOTALS OF C.E. PROJECTS IN LAKE HURON/ST. CLAIR, 1920-1972 (50)
(cubic yards)

| Project | Maintenance | New work | Total |
|---|---|---|---|
| Alpena | 290,036 | 259,877 | 549,913 |
| Au Sable | 273,671 | 25,407 | 299,078 |
| Bay Port | 0 | 29,089 | 29,089 |
| Black River | 563,348 | 57,940 | 621,288 |
| Ch. Lake St. Clair | 3,808,457 | 17,940,248 | 21,748,705 |
| Clinton River | 312,404 | 127,520 | 439,924 |
| Caseville | 25,889 | 62,929 | 88,818 |
| Cheboygan | 410,757 | 173,240 | 583,997 |
| Hammond Bay | 0 | 142,760 | 142,760 |
| Harbor Beach | 228,249 | 260,840 | 489,089 |
| Harrisville | 27,625 | 263,016 | 290,641 |
| Inland Route | 113,055 | 0[b] | 113,055 |
| Les Cheneaux | 102,270 | 66,990 | 169,260 |
| Mackinaw | 0 | 9,869 | 9,869 |
| Point Lookout | 0 | 334,872 | 334,872 |
| Port Sanilac | 80,702 | 0[b] | 80,702 |
| Saginaw River | 6,999,798[a] | 12,938,358[a] | 19,938,156 |
| St. Clair River | 4,112,237 | 27,472,621 | 31,584,858 |
| St. Marys River | 5,418,514 | 32,151,557 | 37,570,071 |
| Sebewaing | 169,120 | 0[b] | 169,120 |
| Totals | 22,936,132 | 92,317,133 | 115,253,265 |

[a]1924 volumes are not known.
[b]No new work reported.

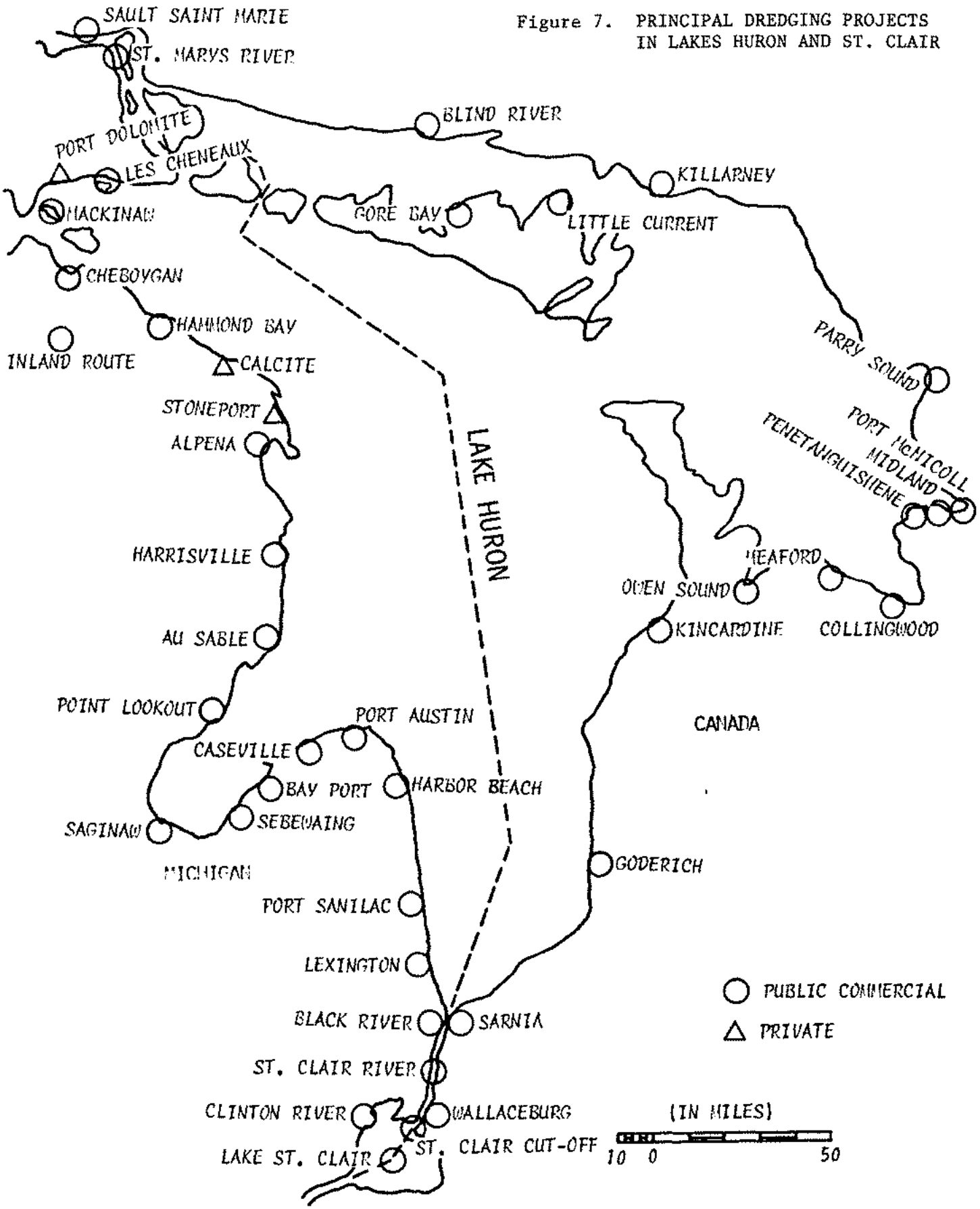



Figure 7. PRINCIPAL DREDGING PROJECTS IN LAKES HURON AND ST. CLAIR

## Past Dredging Activity in Lake Huron and Lake St. Clair

Annual dredging data from 1930 to the present of the C.E. activities in Lake Huron and Lake St. Clair are illustrated in Table 28. Also included are private dredging quantities from 1960 through 1972 and volumes obtained from the D.P.W. and the M.O.T. Over a 42-year period, the C.E. dredging totaled 115,253,275 cubic yards which averages to approximately 2.7 million cubic yards per year. Annual maintenance dredging during this period was approximately 546, 000 cubic yards. As noted in Figure 8 maintenance dredging follows no predictable pattern and great extremes can occur over short intervals. In 1960, for example, dredging volumes were the lowest since 1930 (31,239 CY) and 8 years later, 1969, was a record high dredging year (1.9 million CY). If dredging totals and averages are determined over 4 decades (Table 29), the great range of maintenance dredging is evident. Furthermore, this table reveals that an increase in maintenance dredging over time, as one may expect with an increase in the number of projects and an increase in economic development, is not evident.

A comparison of Canadian and American data from 1961-70 reveals that in these two lakes, 94 percent of all maintenance, new work, and dredging activities by private interests occurred in Michigan. Most of the maintenance dredging (6 million CY) was at Saginaw and the connecting channels of St. Marys and St. Clair Rivers, and Lake St. Clair. A correlation (-0.52) between lake levels and maintenance dredging may account in part for the increased maintenance dredging during the 1960's. However, the high volumes projects may have also been influenced by the high new work projects between 1959 and 1963 which totaled over 29 million cubic yards and have required maintenance. In Ontario, the general dredging pattern is similar to that in Michigan. In the early 1960's, maintenance dredging by the D.P.W. was the highest in a 21-year period (Table 28). New work dredging quantities from 1961-70 by the C.E. was the highest of any Great Lake (3.4 million CY). The ratio between

Table 28. ANNUAL DREDGING VOLUMES IN LAKE HURON/ST. CLAIR, 1930-1972 (48, 49, 50)
T (cubic yards)

| Fiscal year | Maintenance | New work | Private |
|---|---|---|---|
| Michigan | | | |
| 1972 | 215,815 | 197,662 | 1,250 |
| 1971 | 355,205 | 305,951 | 309,000 |
| 1970 | 361,750 | 559,108 | 60,293 |
| 1969 | 833,370 | 5,491,599 | 109,438 |
| 1968 | 1,903,985 | 444,057 | 133,050 |
| 1967 | 407,765 | 1,159,580 | 134,260 |
| 1966 | 1,153,184 | 127,520 | 696,319 |
| 1965 | 923,356 | 752,735 | 536,655 |
| 1964 | 1,156,097 | 199,572 | 308,359 |
| 1963 | 128,900 | 2,297,624 | 369,125 |
| 1962 | 212,975 | 6,056,132 | 264,160 |
| 1961 | 206,379 | 17,115,099 | 75,500 |
| 1960 | 31,239 | 1,502,466 | 26,025 |
| 1959 | 282,453 | 2,018,647 | |
| 1958 | 214,751 | 0 | |
| 1957 | 161,089 | 2,675 | |
| 1956 | 390,197 | 0 | |
| 1955 | 245,607 | 0 | |
| 1954 | 91,910 | 0 | |
| 1953 | 72,460 | 0 | |
| 1952 | 107,835 | 0 | |
| 1951 | 671,919 | 0 | |
| 1950 | 556,243 | 0 | |
| 1949 | 277,857 | 0 | |
| 1948 | 164,855 | 0 | |
| 1947 | 162,278 | 0 | |
| 1946 | 107,712 | 0 | |
| 1945 | 207,487 | 0 | |
| 1944 | 399,449 | 0 | |
| 1943 | 408,838 | 0 | |
| 1942 | 393,442 | 1,093,204 | |
| 1941 | 354,681 | 451,762 | |
| 1940 | 1,439,037 | 556,683 | |
| 1939 | 1,137,374 | 41,667 | |
| 1938 | 477,981 | 539,996 | |
| 1937 | 133,801 | 925,574 | |
| 1936 | 241,860 | 3,881,839 | |
| 1935 | 358,606 | 5,276,934 | |
| 1934 | 61,620 | 8,098,716 | |
| 1933 | 711,160 | 9,281,574 | |

Table 28. (continued)

| Fiscal year | Maintenance | New work | Private |
|---|---|---|---|
| 1934 | 61,620 | 8,098,716 | |
| 1933 | 711,160 | 9,281,574 | |
| 1932 | 201,146 | 9,431,151 | |
| 1931 | 1,242,867 | 1,054,414 | |
| 1930 | 413,913 | 1,466,660 | |
| Totals | 19,580,448 | 80,330,602 | 3,023,434 |
| Ontario | | | |
| 1972 | 109,816 | 73,550 | 5,200 |
| 1971 | 23,303 | 50,500 | 1,000 |
| 1970 | 0 | 30,000 | 7,000 |
| 1969 | 43,911 | 700 | 0 |
| 1968 | 37,459 | 700 | 0 |
| 1967 | 210,797 | 40,453 | 500 |
| 1966 | 192,907 | 63,885 | 500 |
| 1965 | 771,681 | 26,894 | 10,000 |
| 1964 | 765,132 | 52,313 | |
| 1963 | 439,548 | 572 | |
| 1962 | 182,079 | 2,024 | |
| 1961 | 65,667 | 0 | |
| 1960 | 97,168 | 0 | |
| 1959 | 215,870 | 142 | |
| 1958 | 88,535 | | |
| 1957 | 82,907 | | |
| 1956 | 24,752 | | |
| 1955 | 130,233 | | |
| 1954 | 78,213 | | |
| 1953 | 159,487 | | |
| 1952 | 131,276 | | |
| 1951 | 305,855 | | |
| Totals | 4,156,596 | 341,733 | 24,200 |

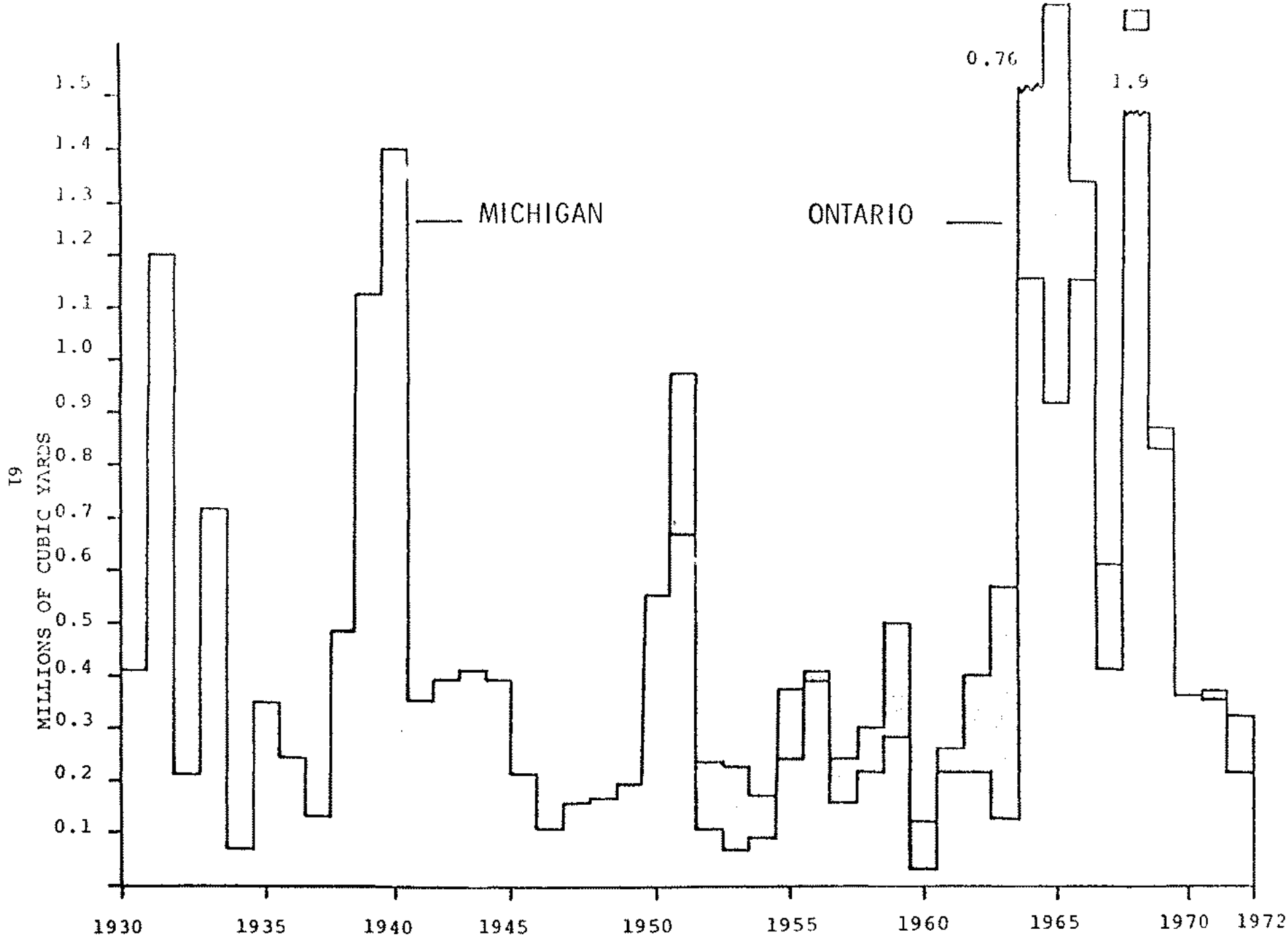



Figure 8. ANNUAL MAINTENANCE DREDGING VOLUMES IN LAKES HURON AND ST. CLAIR, 1930-1972

Table 29. C.E. MAINTENANCE DREDGING BY DECADES IN LAKE HURON/ST. CLAIR, 1930-1970 (50)
(cubic yards)

| Years | Total | Average/Year |
|---|---|---|
| 1960-1969 | 6,957,250 | 695,725 |
| 1950-1959 | 2,794,464 | 279,446 |
| 1940-1949 | 3,915,636 | 391,564 |
| 1930-1939 | 4,980,328 | 498,033 |

maintenance and new work dredging in Michigan from 1961-70 reveals that a year by year comparison (Table 28), with only 2 exceptions, new work dredging exceeds maintenance. As with maintenance dredging, the greatest dredging activity was confined to the connecting channels and Saginaw Harbor. In these 4 projects, approximately 34 million cubic yards of spoil were removed in the 10-year period. Capital dredging in Ontario is difficult to determine because the D.P.W. does not always distinguish it from maintenance dredging. However, as best as could be determined, 217,500 cubic yards of dredgings over the 1961-70 period were removed from 5 projects (i.e., Blind River, Collingwood, Inside Steamer Channel, Midland, and Sault Ste. Marie). Permit dredging in Lake Huron is generally characterized by the excavation of small boat slips associated with recreational marine activity. This is most evident in Lake St. Clair and the lower St. Clair River adjacent to metropolitan Detroit and Windsor. Here projects generally average less than 5,000 cubic yards.

Compared to most other Great Lakes, the private dredging volumes are low and are not necessarily associated with power companies or industry. Only 25 percent of the dredging in Lake Huron is related to industry, which reflects the recreational character of this lake. A similar

pattern is evident in Ontario. The total permit dredging in Michigan from 1960 through 1972 is 3,023,434 cubic yards. In Canada, a minimum 24,200 cubic yards of spoil were removed by private interests from 1965 through 1972. As illustrated in Table 28, the average permit dredging volume in Michigan is 232,572 cubic yards annually. Three large private harbors with project depths of 26 feet are located in Michigan. These are Calcite, Port Dolomite, and Stoneport. Of the 3, only Calcite reported dredging activity since 1960. In a 2-year period, 1964 and 1965, 50,500 cubic yards were removed from that harbor. At Saginaw, the major industrialized project on Lake Huron, private dredging averages about 55,000 cubic yards annually.

Present dredging patterns (1972 through 1973) in terms of geographic distribution are similar to those of the past except that volumes have decreased. Table 30 reflects the dredging activities in the past 3 years of harbors in Michigan and Ontario.

Table 30. TOTAL DREDGING VOLUMES IN LAKE HURON/ST. CLAIR, 1971-1973 (48, 50)
(cubic yards)

| Year | U.S. | Canada | Total |
|---|---|---|---|
| 1973 | 175,589 | not available | at least 175,589 |
| 1972 | 414,727 | 188,566 | 603,293 |
| 1971 | 970,156 | 74,803 | 1,044,959 |

The average maintenance, new work, and permit dredging in the last decade in Michigan has averaged well over one million cubic yards annually. However, with environmental concerns discussed in Section V and perhaps record high lake levels since 1970, dredging volumes including permit dredging have declined to a total of 175, 589 cubic yards in

1973. In Canada, total dredging volumes in the past 2 years have also decreased.

## Future Dredging in Lake Huron and Lake St. Clair--Michigan

Although future dredging is difficult to predict accurately, estimates can be made based on past and present dredging activities. Basically, the volume of spoil to be removed is the sum of projected maintenance dredging, projected new work, and private dredging. How policies, such as PL 91-611, will affect dredging in the next decade cannot be totally or accurately assessed at this point. In the past 2 years maintenance and permit dredging volumes in Michigan have declined, indicating that federal and state policy does play a role in dredging activity. Therefore, a maximum and minimum dredging figure is determined for Lake Huron and Lake St. Clair. Also, based on the historical data, a probable dredging estimate is presented for the next decade.

Future maintenance dredging in Lake Huron and Lake St. Clair is basically related to the projected dredging frequency and volume of spoil removed. Table 31 illustrates the maintenance dredging frequencies of the C.E. projects over the past 13 years. This table reveals that the more commercially significant waterways and harbors, such as Saginaw and the St. Clair River are dredged consistently. Other projects which are economically less important, such as Cheboygan and Alpena are not dredged as often. Most remaining harbors, such as Port Sanilac and Harbor Beach have recreational status and the dredging frequency is low.

In Lake Huron, the dredging period 1961 to 1970 may be selected to obtain a dredging frequency. During the early part of that decade the St. Lawrence Seaway was completed and 27-foot project depths now occur at Saginaw and all Lake Huron and Lake St. Clair connecting channels except Inland Route. Smaller projects, such as Inland Route and Clinton River were actively dredged during the late 1960's and into the 1970's.

Table 31. MAINTENANCE DREDGING FREQUENCIES OF C.E. PROJECTS IN LAKE HURON/ST. CLAIR (50) 1961-1973

| Project | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alpena | | | x | x | x | x | | | x | x | | | |
| Au Sable | x | x | | | x | x | x | x | x | x | x | x | x |
| Bay Port | | | | | | | | | | | | | |
| Black River | | | | | | | | | | | | | |
| Ch. of Lake St. Clair | | | x | x | x | x | x | x | x | | x | | |
| Caseville | | | | | | | | | | | x | | |
| Cheboygan | | x | | x | | x | | x | | | x | | |
| Clinton River | | | | | x | x | | | | | x | | |
| Hammond | | | | | | | | | | | | | |
| Harbor Beach | | | | | | | x | x | | | | x | |
| Harrisville | | | | | x | | | | | | | x | |
| Inland Route | | | | | | | | | | x | x | x | x |
| Les Cheneaux | | | | | | | | x | | | | | |
| Point Lookout | | | | | | | | | | | x | x | |
| Port Sanilac | | x | | x | x | | | | | | | | |
| Saginaw | x | x | x | x | x | x | | x | x | x | x | x | x |
| St. Clair R. | | | x | x | x | x | x | x | x | x | x | x | x |
| St. Marys R. | | | | | | | | x | x | x | | | x |
| Sebewaing | | | | | | x | | | | x | | | |

During most of the 1960's environmental policies such as PL 91-611 and PL 92-500 were not instituted to prohibit dumping or cause dredging to take place in localities where confined sites were available for polluted spoil. Therefore, the decade 1961-70 may be a representative dredging decade since economic stability was reached and environmental policy was less effective in controlling dredging and disposal practices.

As illustrated in Table 31, from 1961 to 1970 the average dredging frequency in Lake Huron and Lake St. Clair was 6 projects per year. The total volume generated during maintenance dredging operations by the C.E. was 7.28 million cubic yards. Therefore in an average year during that decade, 0.73 million yards were removed by an average of 6 projects. Assuming that the status quo is to be maintained in the 1970's and 1980's, an annual projection of about 0.73 million cubic yards may be realistic. However, such a projection does not consider new work projects of the late 1960's and the early 1970's such as at Saginaw and at Sault Ste. Marie. In addition, the more significant environmental policies directly affecting Great Lakes' dredging, such as PL 92-500, were legislated in the 1970's. Thus, a 0.73 million cubic yard projection is somewhat biased since current operational and legislative variables are not considered.

Table 32 represents the dredging the C.E. feels is necessary to maintain harbors and waterways at their project depths over the next decade. Based on this projection, 1.2 million cubic yards are to be removed annually. When compared to Table 28 a record decade is anticipated. Since this projection is almost twice what has been dredged in any of the past 4 decades (1960 to 1969 saw the removal of 6.9 million CY) and most anticipated new work projects are recreational, this projection represents a maximum volume to be removed from Lake Huron/St. Clair in the next decade.

A more accurate estimate of future maintenance dredging is based on projects which have high frequencies and high volumes. Traditionally,

Table 32. C.E. PROJECTED FUTURE MAINTENANCE DREDGING IN LAKE HURON/ST. CLAIR (50)
(cubic yards)

| Project | C.E. annual projection |
|---|---|
| Alpena | 8,000 |
| Au Sable | 30,000 |
| Bay Port | 6,000 |
| Black River | 3,000 |
| Caseville | 12,000 |
| Channels of Lake St. Clair | 200,000 |
| Cheboygan | 10,000 |
| Clinton River | 21,000 |
| Hammond | 10,000 |
| Harbor Beach | 5,000 |
| Harrisville | 12,000 |
| Inland Route | 10,000 |
| Les Cheneaux | 10,000 |
| Mackinaw City | 4,000 |
| Port Austin | 4,000 |
| Port Sanilac | 7,200 |
| Saginaw | 700,000 |
| Sebewaing | 20,000 |
| St. Clair River | 75,000 |
| St. Marys River | 65,000 |
| Total | 1,212,200 per year |

the most significant projects in Lake Huron are Saginaw and the connecting waterways which reflect high dredging frequencies and high volumes because of their commercial significance. Saginaw, the St. Clair River, Lake St. Clair and Au Sable, based on the last decade, have frequencies of 7 or higher (Table 31). These 4 projects and Sault Ste. Marie account for most of the maintenance dredging which occurs in Lake Huron/St. Clair. Table 33 reveals that these projects, on a short term basis (1961-70) and on a long time basis (1920-72), have accounted for 86 and 90 percent respectively of all C.E. maintenance dredging in these lakes. Furthermore, the C.E. would like to maintain the same ratio in the future. Based on the C.E. future maintenance dredging (Table 32), 88 percent of the spoil will be removed from these projects. Therefore, it may be concluded that about 88 percent of all C.E. maintenance dredging in the past and future was and will continue to be from the 5 most significant projects. The volume removed from all remaining projects will account for approximately 12 percent of the dredging volume.

Table 33. PAST, PRESENT AND FUTURE MAINTENANCE DREDGING OF MAJOR PROJECTS IN LAKE HURON/ST. CLAIR (50)
(cubic yards)

| | 1920-1972 | 1961-1970 | 1973-1983 |
|---|---|---|---|
| Au Sable | 273,671 | 97,680 | 30,000 |
| Ch. Lake St. Clair | 3,808,457 | 1,068,280 | 200,000 |
| Saginaw | 6,999,798 | 2,947,350 | 700,000 |
| St. Clair R. | 4,112,237 | 919,150 | 75,000 |
| Totals | 15,194,163(66%) | 5,032,460(69%) | 1,005,000(83%) |
| Sault Ste. Marie | 5,418,514(24%) | 1,219,120(17%) | 65,000 (5%) |
| Percent from above projects | 90% | 86% | 88% |

To obtain mean maintenance dredging quantities for the 5 major projects in Lake Huron and Lake St. Clair, the dredging volumes since the last new work were determined. It is felt that at least 5 years of maintenance dredging would be required to obtain a representative average quantity. At Saginaw, for example, the last new work project occurred in 1970, however, the average maintenance dredging volume was determined from 1964 to 1972. The table below (Table 34) represents the average maintenance dredging of the 5 major C.E. projects.

Table 34. ANNUAL MAINTENANCE DREDGING OF MAJOR C.E. PROJECTS, LAKE HURON/ST. CLAIR
(cubic yards)

| Project | Base period | Volume |
|---|---|---|
| Au Sable | 1961-1972 | 20,828 |
| Ch. Lake St. Clair | 1964-1972 | 117,677 |
| Saginaw | 1964-1972 | 334,872 |
| St. Clair R. | 1965-1972 | 108,513 |
| Sault Ste. Marie | 1968-1972 | 243,824 |
| Total | | 825,714 |

The total of the projects in Table 34 is 825,714 cubic yards which represents annual maintenance dredging for the next decade. An additional 12 percent, or 99,085 cubic yards is an approximate dredging quantity for the remaining C.E. projects. Therefore, the anticipated maintenance dredging for the C.E. projects in Lake Huron and Lake St. Clair over the next decade, will average 9,247,990 cubic yards, or approximately 925,000 cubic yards annually.

The above technique for obtaining averages may also be applied to individual projects in Michigan since in every case new work is recorded separately from maintenance dredging. In some projects, such as at Alpena, Inland Route, and Port Sanilac, no new work was recorded for 10 to 15

years. In such projects maintenance dredging occurred fairly consistently for several years in the recent past (Table 31). At Alpena, for example, maintenance dredging occurred 6 times from 1963 to 1972. These data were tabulated and a future average calculated. Table 35 is the result of that calculation. The projections by harbor reveal that the 5 principal projects (Au Sable, St. Clair River, Lake St. Clair, Saginaw, and the St. Marys River) represent 85 percent of the total quantity to be removed. This compares favorably with the 86 to 90 percent figure indicated on Table 34. Also, the total annual maintenance dredging volume (967,758 cubic yards) is comparable to the 925,000 cubic yards derived from clustering the 5 principal projects. Although, in some instances, compared with the C.E. projection, differences occur (e.g., Saginaw) based upon maintenance dredging histories over the past few years the projection reflects modern harbor conditions in Lakes Huron and St. Clair.

With the recent introduction and enforcement of environmental constraints (PL 91-611) maintenance dredging activities in the past few years have decreased. This pattern is reflected in all the Great Lakes including Lake Huron and Lake St. Clair. Corps of Engineers dredging activity in FY 1972 and FY 1973 was 379,314 and 165,549 cubic yards respectively. These figures include new work as well as maintenance dredging. Assuming that: (1) 10-year disposed sites in areas of polluted sediments are not constructed; (2) E.P.A. upholds the present pollution criteria and that local interests at Saginaw cannot meet the cost of a containment area as specified in PL 91-611 Sec. 123 (C) (2) or the request for a waiver is not recommended by the E.P.A.; and (3) no economic stress occurs, the average maintenance dredging volume will remain at about 250,000 cubic yards per year. Thus, the figure of 250,000 cubic yards represents a minimum annual average for Lake Huron based principally on events over the last 3 or 4 years.

Table 35. FUTURE ESTIMATED MAINTENANCE DREDGING BY HARBOR OF C.E. PROJECTS (50)
(cubic yards)

| Project | Base period | Average annual maintenance dredging | C.E. projection |
|---|---|---|---|
| Alpena | 1963-1972 | 9,768 | 8,000 |
| Au Sable | 1961-1972 | 20,828 | 30,000 |
| Bay Port | -- | 0 | 6,000 |
| Black River | -- | 0 | 3,000 |
| Caseville | 1965-1972 | 3,236 | 12,000 |
| Channels of Lake St. Clair | 1964-1972 | 117,677 | 200,000 |
| Cheboygan | 1962-1972 | 11,614 | 10,000 |
| Clinton River | 1968-1972 | 7,602 | 21,000 |
| Hammond Bay | -- | 0 | 10,000 |
| Harbor Beach | 1967-1972 | 32,083 | 5,000 |
| Harrisville | 1965-1972 | 3,453 | 12,000 |
| Inland Route | 1968-1972 | 22,611 | 10,000 |
| Les Cheneaux | 1968-1972 | 20,545 | 10,000 |
| Mackinaw | -- | 0 | 4,000 |
| Point Lookout | -- | 0 | 0 |
| Port Austin | -- | 0 | 4,000 |
| Port Sanilac | 1962-1972 | 6,973 | 7,200 |
| Saginaw | 1964-1972 | 334,871 | 700,000 |
| St. Clair River | 1965-1972 | 108,513 | 75,000 |
| St. Marys River | 1968-1972 | 243,824 | 65,000 |
| Sebewaing | 1966-1972 | 24,160 | 20,000 |
| Totals | | 967,758 | 1,212,200 |

Several factors suggest that more than the minimum yardage will be removed from Lake Huron. Of the 4 principal harbors and waterways, Sault Ste. Marie, Saginaw, Lake St. Clair and the St. Clair River, sediment pollution is identified as a problem at only 2 projects (Saginaw and Lake St. Clair). Confined disposal sites are planned for Saginaw and Lake St. Clair and are to be completed in June, 1977 and June 1975 respectively. Saginaw has requested the E.P.A. to recommend a waiver (PL 91-611) which, if recommended and granted, will alleviate 25 percent of the construction costs to Saginaw of a confined disposal site. Also, constructive criticism of the E.P.A. pollution criteria for dredged material is being evaluated and may be modified in the near future. Lake levels in the next decade, which are of some significance, will probably drop from their record highs of the early 1970's requiring more maintenance dredging to alleviate the problems of economic stress to industrial and shipping firms.

Future Permit Dredging in Michigan

Permit dredging over the next decade is difficult to predict. This is especially the case in Lake Huron where some 25 percent of the private dredging is from industrial areas such as Saginaw. Such private dredging is dictated by the same policy as C.E. maintenance dredging. If the spoil is polluted it must be confined. Since a confined site is scheduled for Saginaw, it may be expected that permit dredging volumes in that area will be low until the site is constructed. Permit dredging (Table 28) in 1972 was at a record low (1,250 CY) suggesting again that environmental policies (Section V), and perhaps high lake levels influence private dredging volumes. The C.E., however, suggests that 200,000 cubic yards of permit dredging will occur annually in Lake Huron and Lake St. Clair. Based on a 10-year period (1961-70), 268,000 cubic yards were removed annually. Since the C.E. does not anticipate expanding any commercial harbors in the next decade and no significant

private expansion is expected, permit dredging will remain between 200,000 and 268,000 cubic yards or about 235,000 yards annually.

## Scheduled New Work Dredging in Lake Huron and Lake St. Clair

Table 36 illustrates new work or capital dredging in Lake Huron and Lake St. Clair over the next decade. New work must be justified and it normally takes several years before a project is authorized and completed. Quite possibly some projects may be curtailed or delayed because of environmental, economic, and/or feasibility factors. A capital dredging project at Sault Ste. Marie, Ontario was proposed in the

Table 36. FUTURE NEW WORK IN LAKE HURON/ST. CLAIR, 1973-1983 (48, 50)
(cubic yards)

| Project | Volume | Date of completion |
|---|---|---|
| Sault Ste. Marie | | |
| a) Angle Courses | 893,500 | 1976 |
| b) Point Iroquois | 3,995,000 | 1973 |
| c) Ontario | 1,150,000 | 1975 |
| De Tour | 4,000 | 1979 |
| Black River, Alcona Co. | 110,000 | 1980 |
| Forestville | 73,400 | 1979 |
| Middle Island Harbor | 40,000 | 1983 |
| Grindstone City | 75,000 | 1979 |
| Lexington | 4,700 | 1976 |
| Black River, Port Huron | 140,000 | 1974 |
| Middle Channel St. Clair River, Michigan | 60,000 | 1976 |
| Lake St. Clair, Ontario | 60,000 | 1974 |
| Total | 6,605,000 | |

late 1950's and is yet to be initiated in the field. Therefore, the new work dredging, which totals 6,605,600 cubic yards, represents a maximum anticipated value over the next decade.

With few exceptions such as at Sault Ste. Marie, most new work does not involve expansion of established commercial projects. These new projects are to accommodate shallow watercraft (8-12 feet) and are designed for recreational use. Future economic and industrial expansion of American and Canadian harbors on Lake Huron is not anticipated by the C.E. or the Ministry of Transport (M.O.T.). Therefore, expansion to 27-foot channels is not expected over the next decade. The new work dredging data suggest, that an economic plateau in terms of project depths will occur, and that dredging in Lake Huron will level off with the completion of the high volume projects at Sault Ste. Marie in 1975 and 1976.

Future Dredging in Lake Huron and Lake St. Clair, Ontario

As in the U.S., most of the 50 Canadian projects dredged by the D.P.W. are recreational and are not dredged frequently or with any consistency. However, based on a 10-year average, approximately 27 percent of all Lake Huron maintenance dredging occurs in Canada. If the 924,799 future annual average is maintained in the U.S. projects in Lake Huron/St. Clair, it may be expected that 250,000 cubic yards will be removed during maintenance dredging activities from Ontario ports in Lake Huron/St. Clair. The annual average maintenance dredging in the past 22 years (1951-1972) was 188,934 (Table 28). However, based on future plans both figures appear to be low. The D.P.W.-scheduled maintenance dredging activity on Table 37 includes the period from 1973 through 1977. According to these data, an average of 317,575 cubic yards will be removed by 1977 which is a substantial increase over the past 2 decades. Although future new work is presented in Table 36, some new work may be incorporated in Table 37 since capital dredging is often difficult to

Table 37. FUTURE DREDGING IN CANADIAN PROJECTS IN LAKE HURON/ST. CLAIR, 1973-1977 (48, 49)
(cubic yards)

| Project | Volume |
|---|---|
| Belle River | 26,000 |
| Byng Inlet | 48,874 |
| Cedar Beach | 7,000 |
| Collingwood | 70,000 |
| Goderich | 70,000 |
| Grand Bend | 40,000 |
| Kincardine | 15,000 |
| Midland | 5,000 |
| Oliphant | 10,000 |
| Pike Creek | 16,000 |
| St. Clair Cut-off | 1,200,000 |
| Sault Ste. Marie | 12,500 (1973) and 13,500 (1976) |
| Sarnia | 26,000 |
| Sydenham | 28,000 |
| Total | 1,587,874 |

separate from Canadian maintenance dredging. This being the case, 317,575 cubic yards represents a maximum annual figure.

Permit dredging in Lake Huron and Lake St. Clair is presented in Table 28. Permit dredging, administered by the M.O.T., averages about 2,000 cubic yards annually. Most projects on Lake Huron are for small private boat slips which may require the removal of 300 to 500 CY per project. The M.O.T. expects private dredging to level off to 8 to 10 projects on Lake Superior and Lake Huron over the next few years. The future permit

dredging under the NWPA is anticipated to remain at about 2,000 cubic yards per year.

In summary, future maintenance dredging on the Ontario shore of Lake Huron and Lake St. Clair will probably range between 250,000 to 318,000 cubic yards per year. Most D.P.W. personnel believe that all scheduled dredging will occur. Thus, the latter figure is probably more accurate based in part on the following: (1) dredging projects are dispersed, the volumes are generally small, and few disposal problems occurred thus far; (2) although some projects exceed the M.O.E. pollution parameters, few harbors have been sampled and open-lake disposal is occurring; (3) by 1977, 1.2 million cubic yards will have been dredged from the economically important St. Clair Cut-off channel. Although the sediment exceeds the M.O.E. pollution criteria, confined facilities are currently being tested at Mitchell Bay in Lake St. Clair; it appears that the D.P.W. and the M.O.T. (as in Toronto Harbor) are anticipating a confined disposal program for polluted spoil in the future; (4) lake levels will probably drop in the next few years and commercial projects particularly at Collingwood, Midland, and St. Clair Cut-off will have to be maintained if economic stress is to be avoided.

Summary

Future maintenance and permit dredging in Lake Huron and Lake St. Clair is estimated to be approximately 1.5 million yards per year (Table 38). Since most of the confined disposal sites will not completed until 1976 or 1977, it can be expected that maintenance and private dredging volumes will remain low for the next 2 to 3 years. By the end of the decade, confined disposal sites are to be available for polluted dredgings and with anticipated lower lake levels, maintenance and permit dredging activity will increase.

In addition to the above, the following trends are anticipated in Lake Huron and Lake St. Clair:

Table 38. FUTURE DREDGING ESTIMATES IN LAKE HURON/ST. CLAIR
(cubic yards)

| | Michigan | | Ontario |
|---|---|---|---|
| Maintenance | 925,000 | | 318,000 |
| Permit | 235,000 | | 2,000 |
| Annual totals | 1,160,000 | | 320,000 |
| Total for Lake Huron | | 1,480,000 annually | |
| New work | 5,395,600 | | 1,210,000 |

1. Maintenance dredging will increase. The C.E. projects 1.2 million cubic yards of annual maintenance dredging in the next decade. Our projection (0.9 million cubic yards) is about 25 percent or 300,000 cubic yards lower than the C.E. projection.

2. Scheduled new work dredging will remain high (0.6 million cubic yards annually). With the completion of new work projects at Sault Ste. Marie in 1976, most new work will occur at recreational or shallow draft harbors.

3. High maintenance dredging will remain at the St. Clair River, Lake St. Clair, Sault Ste. Marie, and Saginaw. These projects will account for approximately 88 percent of future maintenance dredging.

## DREDGING QUANTITIES IN LAKE MICHIGAN

For the benefit of commercial navigation, recreation, and fishing in Lake Michigan, 6 private harbors and 42 public harbors and waterways must be dredged (Figure 9). Although private recreational harbors have not been mapped in Figure 9, quantities dredged from these harbors have been incorporated into the private dredging data. Private commercial harbors are few in number and require relatively little dredging. Of

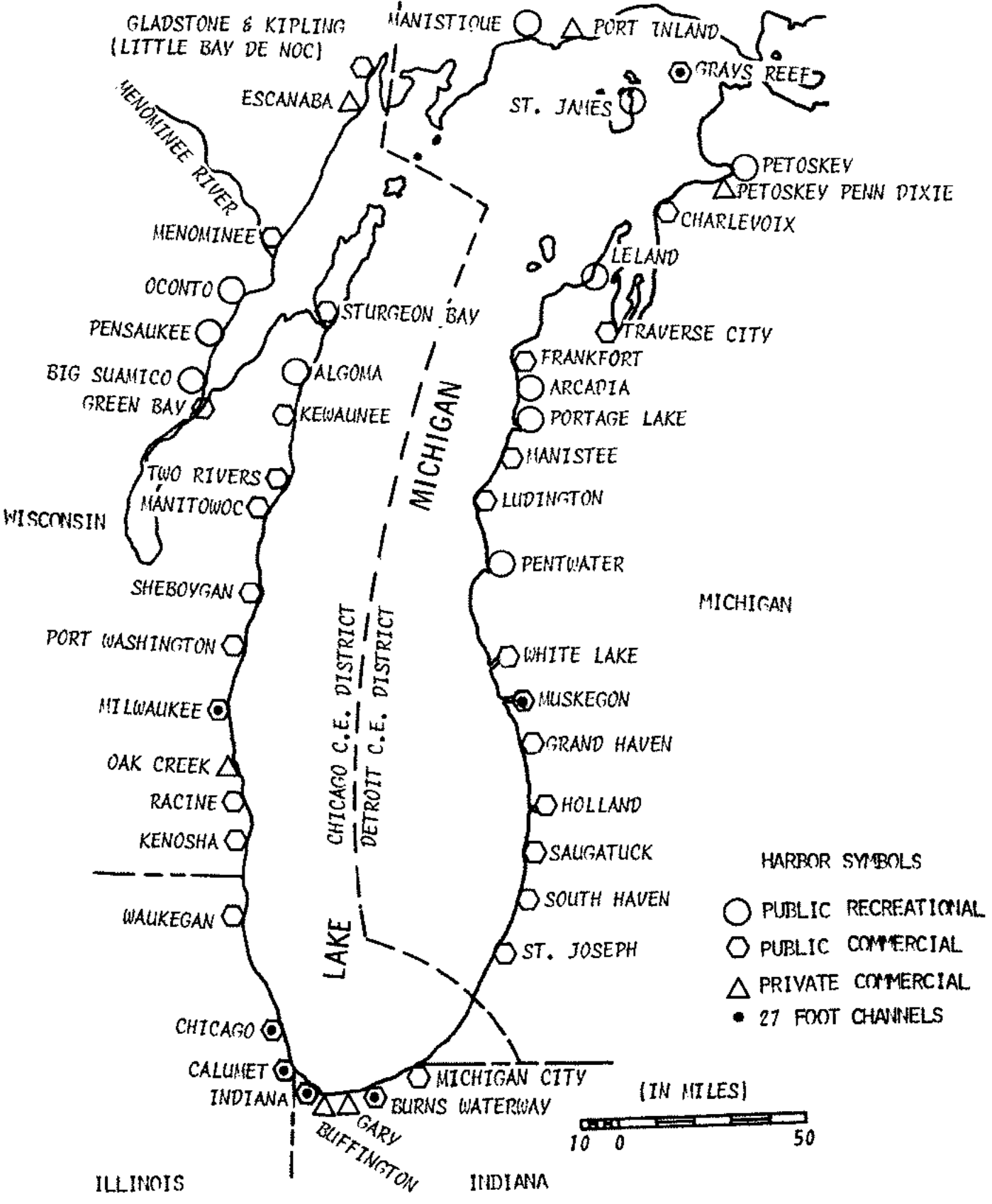



Figure 9. PRIVATE COMMERCIAL AND PUBLIC HARBORS AND C.E. DISTRICTS IN LAKE MICHIGAN

the public commercial and recreational harbors and waterways, which are maintained by the C.E., 22 are located in the Chicago District and 20 are part of the Detroit District.

The economic status and commerce of the private and public harbors are presented by C.E. district in Table 39. Public harbors and waterways which can accommodate vessels with Seaway drafts of 27 feet include Burns Waterway, Calumet, Chicago, Grays Reef, Indiana, Milwaukee, and Muskegon. In the Chicago District, those commercial harbors which are declining in commerce are Kenosha, Michigan City, Racine, Sheboygan, and Two Rivers. In the Detroit District, harbors which are declining in commercial importance include Charlevoix, Manistique, Pentwater, Saugatuck, South Haven, and White Lake.

Dredging operations by private interests probably were initiated soon after white settlement of the territories, but records of dredging quantities are available only to 1957. Many of the public harbors, such as Holland Harbor which was constructed in 1852, have long been in existence. Though the removal of sediments from public harbors began after the mid-1800's, records maintained by the C.E. are available only from 1918.

## Private Dredging Quantities

Available data regarding volumes of spoil dredged by private interests in the Chicago and Detroit Districts are presented in Table 40. Because of the low priority of Section 10 permit records, these data are incomplete and available only from 1957. In the past, especially in northern Wisconsin and upper Michigan, private interests, such as operators of marinas, frequently dredged boat slips and other facilities without applying for a Section 10 permit. In addition, the C.E. lacks the manpower to field check permittees to ensure compliance with the permit, including the yardage actually dredged. Private dredging is considered to be reported in place measure.

Table 39. ECONOMIC STATUS AND 1972 COMMERCE OF HARBORS BY C.E. DISTRICT, LAKE MICHIGAN (5)

| Public Harbors | Economic status | Tons of commerce |
|---|---|---|
| Chicago District | | |
| Algoma | Recreational/Fishing | 826 |
| Big Suamico | Recreational/Fishing | 0 |
| Burns Waterway[a] | Commercial | 4,759,827 |
| Calumet H. & R.[a] | Commercial | 25,431,158 |
| Chicago H. & R.[a] | Commercial | 4,516,892 |
| Gladstone-Kipling | Commercial | 292,031 |
| Green Bay | Commercial | 2,823,604 |
| Indiana[a] | Commercial | 17,610,662 |
| Kenosha | Commercial | 103,648 |
| Kewaunee | Commercial | 1,205,791 |
| Manitowoc | Commercial | 1,818,313 |
| Menominee | Commercial | 152,568 |
| Michigan City | Commercial/Recreational | 371 |
| Milwaukee[a] | Commercial | 5,373,630 |
| Oconto | Recreational/Fishing | 1,041 |
| Pensaukee | Recreational/Fishing | 2,943 |
| Port Washington | Commercial/Recreational | 717,312 |
| Racine | Commercial/Recreational | 100,192 |
| Sheboygan | Commercial/Recreational | 221,128 |
| Sturgeon Bay/Ship Canal | Commercial | 216,650 |
| Two Rivers | Commercial | 99,447 |
| Waukegan | Commercial | 436,710 |
| Total | | 65,884,744 |
| Private harbors | | |
| Buffington | Commercial | 1,731,519 |
| Escanaba | Commercial | 10,954,237 |
| Gary | Commercial | 8,751,620 |
| Oak Creek | Commercial | 920,766 |
| District total | | 88,242,886 |

Table 39. (continued)

| Public harbors | Economic status | Tons of commerce |
|---|---|---|
| Detroit District | | |
| Arcadia | Recreational | 0 |
| Charlevoix | Commercial/Recreational | 185,523 |
| Frankfurt | Commercial | 1,353,101 |
| Grand Haven | Commercial | 2,977,109 |
| Grays Reef[a] | Commercial (Passageway) | 6,080,391 |
| Holland | Commercial/Recreational | 261,738 |
| Leland | Recreational | 1,134 |
| Ludington | Commercial | 3,368,015 |
| Manistee | Commercial/Recreational | 522,741 |
| Manistique | Recreational/Fishing | 135 |
| Muskegon[a] | Commercial | 2,835,823 |
| Pentwater | Recreational/Fishing | 0 |
| Petoskey | Recreational | 0 |
| Portage Lake | Recreational | 0 |
| Saugatuck | Commercial/Recreational | 212 |
| South Haven | Commercial | 45,915 |
| St. James (Beaver Island) | Recreational | 2,559 |
| St. Joseph | Commercial | 475,139 |
| Traverse City | Commercial/Recreational | 446,244 |
| White Lake | Commercial/Recreational | 3,615 |
| Total | | 18,559,394 |
| Private harbors | | |
| Petoskey Penn Dixie | Commercial | 473,074 |
| Port Inland | Commercial | 4,199,020 |
| Total | | 4,672,094 |
| District total | | 23,231,488 |
| Totals for lake | | 111,474,374 |

[a]Harbors with project depths of 27 feet.

Table 40. PRIVATE DREDGING VOLUMES IN LAKE MICHIGAN BY C.E. DISTRICT, 1957-1973 (51, 52)
(cubic yards)

| Fiscal year | Chicago District | Detroit District | Total |
|---|---|---|---|
| 1973 | 193,425 | 80,000 | 273,425 |
| 1972 | 336,278 | 762,505 | 1,098,783 |
| 1971 | 400,727 | 72,000 | 472,727 |
| 1970 | 602,700 | 29,560 | 632,260 |
| 1969 | 160,237 | 41,000 | 201,237 |
| 1968 | 787,087 | 57,288 | 844,375 |
| 1967 | 468,245 | 842,500 | 1,310,745 |
| 1966 | 399,982 | 31,450 | 431,432 |
| 1965 | 1,053,598 | 41,000 | 1,094,598 |
| 1964 | 390,971 | 24,800 | 415,771 |
| 1963 | 279,677 | 0 | 279,677 |
| 1962 | 437,039 | 50,200 | 487,239 |
| 1961 | 1,567,196 | 8,345 | 1,575,541 |
| 1960 | 1,047,411 | a | 1,047,411 |
| 1959 | 1,050,156 | a | 1,050,156 |
| 1958 | 1,149,827 | a | 1,149,827 |
| 1957 | 969,982 | a | 969,982 |
| Totals | 11,294,538 | 2,040,648 | 13,335,186 |

[a]Data not available.

Based on the period 1957 through 1973, private dredging in Lake Michigan averaged 784,420 cubic yards annually; this quantity is approximately 18 percent of the total average annual dredging volume. Private dredging operations include the excavation and maintenance of private harbors and marinas as well as private boat slips and berthing facilities in public harbors. However, most of the spoil is derived from private docking facilities in public harbors, and not from private harbors. Volumes derived from dredging for bulkhead construction and fill operations were not considered herein to constitute private dredging. In addition, inland dredging, i.e., dredging upstream from a rivermouth harbor, was not included in the private dredging volumes.

Large volumes, i.e., over 100,000 cubic yards per permit, were frequently dredged by Inland Steel, U.S. Steel, and Youngstown Sheet and Tube from Indiana and Calumet Harbors. Municipalities and power companies, e.g., Commonwealth Edison, occasionally generate moderately large dredging projects. Conversely, smaller industries and firms, such as yacht clubs, make numerous permit applications, but these projects usually involve less than 25,000 cubic yards of spoil per permit.

In most instances the sediment removed by private interests was dumped on the permittee's property. During its review of Section 10 permit applications, the E.P.A. generally recommends that spoil be confined and not returned to the waters of the Great Lakes or rivers, nor disposed on nearshore environments where it may be washed or leached into the lakes or rivers. A few large industries and municipalities have requested permission to dump spoil in federal disposal sites. At present the C.E. must allow some capacity in their confined disposal sites for such requests.

The C.E. does not dredge private navigational facilities. In the Chicago District, 3 large industries were recently assessed, pro rata, the cost of dredging by the C.E. for causing sedimentation in federal harbors. Sloughing of sediment from privately-maintained channels into

Table 41. ANNUAL MAINTENANCE AND NEW WORK DREDGING VOLUMES IN PUBLIC HARBORS OF LAKE MICHIGAN BY C.E. DISTRICT, 1918-1973 (50, 52)
(cubic yards)

| Fiscal year | Chicago District | | Detroit District | | Totals |
|---|---|---|---|---|---|
| | Maintenance | New work | Maintenance | New work | |
| 1973 | 811,274 | 624,296 | 597,360 | 0 | 2,032,930 |
| 1972 | 545,018 | 1,410,831 | 391,552 | 44,378 | 2,391,779 |
| 1971 | 217,621 | 908,056 | 461,161 | 15,650 | 1,602,488 |
| 1970 | 495,926 | 1,631,174 | 799,890 | 4,524 | 2,931,514 |
| 1969 | 695,696 | 1,089,236 | 594,515 | 145,701 | 2,525,148 |
| 1968 | 956,687 | 1,865,902 | 613,856 | 61,300 | 3,497,745 |
| 1967 | 669,262 | 2,197,681 | 702,797 | 16,524 | 3,586,264 |
| 1966 | 319,693 | 6,187,987 | 667,606 | 10,571 | 7,185,857 |
| 1965 | 1,387,892 | 3,257,264 | 618,952 | 190,837 | 5,454,945 |
| 1964 | 1,344,556 | 1,698,138 | 800,215 | 387,412 | 4,230,321 |
| 1963 | 1,195,469 | 958,784 | 436,261 | 72,211 | 2,662,725 |
| 1962 | 876,049 | 458,764 | 535,996 | 0 | 1,870,809 |
| 1961 | 810,417 | 94,103 | 226,756 | 263,325 | 1,394,601 |
| 1960 | 742,389 | 64,581 | 597,183 | 0 | 1,404,153 |
| 1959 | 909,232 | 0 | 322,048 | 0 | 1,231,280 |
| 1958 | 658,950 | 87,791 | 459,770 | 47,610 | 1,254,121 |
| 1957 | 1,117,768 | 491,654 | 377,273 | 256,148 | 2,242,843 |
| 1956 | 618,085 | 91,643 | 365,309 | 0 | 1,075,037 |
| 1955 | 411,044 | 45,133 | 370,839 | 0 | 827,016 |
| 1954 | 279,379 | 0 | 400,509 | 0 | 679,888 |
| 1953 | 556,525 | 0 | 287,084 | 0 | 843,609 |
| 1952 | 296,630 | 0 | 320,206 | 0 | 616,836 |
| 1951 | 618,396 | 0 | 595,548 | 0 | 1,213,944 |
| 1950 | 892,748 | 0 | 553,092 | 245,772 | 1,691,612 |
| 1949 | 493,557 | 0 | 642,085 | 208,909 | 1,344,551 |
| 1948 | 939,100 | 0 | 549,827 | 0 | 1,488,927 |
| 1947 | 257,096 | 191,184 | 333,118 | 0 | 781,398 |
| 1946 | 578,888 | 5,238 | 257,218 | 0 | 841,344 |

Table 41. (continued)

| Fiscal year | Chicago District | | Detroit District | | Totals |
|---|---|---|---|---|---|
| | Maintenance | New work | Maintenance | New work | |
| 1945 | 784,955 | 0 | 376,412 | 0 | 1,161,367 |
| 1944 | 1,009,934 | 152,360 | 362,951 | 0 | 1,525,245 |
| 1943 | 1,051,572 | 318,153 | 436,976 | 0 | 1,806,701 |
| 1942 | 582,444 | 347,400 | 433,912 | 0 | 1,363,756 |
| 1941 | 593,480 | 468,854 | 396,607 | 0 | 1,458,941 |
| 1940 | 675,885 | 523,716 | 550,216 | 189,154 | 1,938,971 |
| 1939 | 862,944 | 1,836,835 | 523,709 | 671,072 | 3,894,560 |
| 1938 | 428,347 | 343,079 | 540,722 | 54,136 | 1,366,284 |
| 1937 | 900,210 | 3,817,223 | 517,811 | 16,137 | 5,251,381 |
| 1936 | 648,157 | 4,114,580 | 491,037 | 0 | 5,253,774 |
| 1935 | 920,479 | 2,623,095 | 578,589 | 0 | 4,122,163 |
| 1934 | 589,964 | 328,448 | 589,307 | 0 | 1,507,719 |
| 1933 | 889,403 | 319,542 | 473,431 | 282,727 | 1,965,103 |
| 1932 | 374,907 | 1,037,174 | 520,757 | 156,320 | 2,089,158 |
| 1931 | 1,499,869 | 379,111 | 256,889 | 350,213 | 2,486,082 |
| 1930 | 914,778 | 233,214 | 499,284 | 0 | 1,647,276 |
| 1929 | 343,903 | 335,837 | 228,847 | 0 | 908,587 |
| 1928 | 623,858 | 0 | 305,393 | 0 | 929,251 |
| 1927 | 907,814 | 411,300 | 0 | 0 | 1,319,114 |
| 1926 | 495,986 | 0 | 0 | 0 | 495,986 |
| 1925 | 418,326 | 366,957 | 0 | 0 | 785,283 |
| 1924 | 388,279 | 185,120 | 0 | 0 | 573,399 |
| 1923 | 396,709 | 0 | 0 | 0 | 396,709 |
| 1922 | 471,070 | 0 | 0 | 0 | 471,070 |
| 1921 | 329,809 | 0 | 0 | 0 | 329,809 |
| 1920 | 166,142 | 201,019 | 147,555 | 0 | 514,716 |
| 1919 | 268,422 | 0 | 153,400 | 17,046 | 438,868 |
| 1918 | 165,267 | 88,610 | 124,997 | 117,514 | 496,388 |
| Totals | 37,398,260 | 41,791,067 | 22,386,828 | 3,825,191 | 105,401,346 |

public channels maintained by the C.E. slightly reduces the quantity of private dredging in the public harbors. In several harbors, especially in Calumet, Chicago and Indiana Harbors, both public and private dredging volumes are decreasing due to reduced industrial sedimentation and sewage deposits. The federal project limit in Calumet Harbor was recently extended inland, resulting in a reduction of some private dredging.

Public Dredging Quantities

Since 1918, 105 million cubic yards of sediment have been dredged from the public harbors and waterways of Lake Michigan (Table 41). Of the total quantity dredged, 57 percent, or 60 million cubic yards, was derived from maintenance dredging operations, whereas the remainder involved new work dredging. When the dredging quantities are compared by district, the larger volumes in the Chicago District are obvious. In the Detroit District, maintenance dredging quantities are moderate. Relatively little new work dredging has been done. Historical dredging records in Chicago for years prior to 1935 are incomplete. In the Detroit District records, there is a hiatus from 1920 through 1927.

The period 1935 through 1973 may be selected as a base for the calculation of long-term dredging averages or means. In the Chicago District the long-term mean for annual maintenance and new work dredging volumes are 721,900 and 971,900 cubic yards, respectively. In the Detroit District the average annual maintenance is 489,400 cubic yards, while new work dredging quantities average 74,400 cubic yards. With regard to all of Lake Michigan, the mean annual maintenance dredging quantity is 1,211,300 cubic yards and the mean new work dredging volume is 1,046,300 cubic yards. Even though the project depths in most harbors have increased over the years, the historical maintenance dredging does not exhibit a steady upward trend.

The volume of annual maintenance dredging in the Chicago District has been more variable than that of the Detroit District. Years with above average maintenance dredging are characterized by the coincidence of 2 or more very large dredging projects within the same fiscal year. Much of the dredged spoil from the Chicago District is derived from industrial sediments and municipal sewage as well as from littoral and fluvial (stream) transport processes. In the Detroit District, the source of harbor sediments is primarily the result of littoral drift which apparently is fairly constant from year to year.

Shoaling within the harbors, lake levels below mean low datum, and availability of federal funds appear to be positively correlated with the scheduling of maintenance dredging projects. Based on the period 1935-1973, an annual average of 22 harbors underwent maintenance dredging in Lake Michigan. In the Chicago District, fewer harbors than usual were scheduled for maintenance dredging during the period 1970 through 1973 as the open-lake disposal of dredged spoil was being re-evaluated. During the low lake level years of 1963 to 1965, the C.E. maintained harbors at maximum project depths to avoid groundings. The Korean War effort in the early 1950's was accompanied by a reduction in the funding of federal projects. During this period, the C.E. dredged fewer projects, and very few projects were contracted to private dredgers.

Unlike maintenance dredging, most of the new work dredging was performed in 3 time periods. First, stimulated by shipping needs of the lumber industry as well as by demands for ferry and excursion boats, a number of public harbors were constructed in the late 1800's. The second period, the 1930's, was characterized by the deepening and widening of many harbors. During this time harbor depths commonly ranged from 18 to 25 feet. Finally, the period with the largest volume of new work dredging was the 1960's and early 1970's when many industrial harbors were deepened to meet the 27-foot draft requirement of the St. Lawrence Seaway system. New work was carried out in Burns Waterway, Calumet Harbor

and River, Chicago Harbor and River, Green Bay, Indiana, and Milwaukee Harbors. Between these 3 periods, as in the 1920's as well as in the 1940's and 1950's, few new work projects were scheduled.

As indicated by Table 42, the total quantity of spoil dredged varies tremendously from harbor to harbor. In general, public harbors with heavy industries and 27-foot project depths have the largest dredging requirements. Conversely, small quantities are extracted from recreational harbors wherein project depths usually range from 12 to 14 feet. In this study, Chicago Harbor and River are separated into 2 areas. No dredging quantities were indicated in the Corps of Engineers' records for Arcadia, Petoskey, St. James, and Traverse City Harbors.

The maintenance/new work ratio (M/NW) may be employed to identify those harbors which have undergone little expansion or those which are costly to maintain because of high maintenance dredging requirements. It is obtained by dividing the total new work dredging quantity into the total maintenance dredging volume for each harbor. The M/NW ratio for all public harbors of Lake Michigan is 1.3, whereas the Chicago District averages 0.9 and the Detroit District mean is 5.9 (Table 42). In general, harbors in the Detroit District exhibit relatively high maintenance dredging requirements and little harbor expansion or deepening has occurred in that area.

## Present Dredging Quantities

The quantity of sediment currently being dredged in Lake Michigan is based on a 10-year average from the period 1961 through 1970. The years 1971 through 1973 were not included in the average because maintenance dredging volumes were below normal, especially in the Chicago District, due to the temporary ban on open-lake disposal of dredged spoil.

Table 43 shows the average annual private, maintenance, and new work dredging quantities by C.E. district. The average annual private

Table 42. TOTAL MAINTENANCE AND NEW WORK DREDGING VOLUMES BY HARBOR IN LAKE MICHIGAN BY C.E. DISTRICT, 1918-1973 (50, 52)
(cubic yards)

| Public harbors | Maintenance | New work | Totals | M/NW ratio |
|---|---|---|---|---|
| Chicago District | | | | |
| Algoma | 200,210 | 0 | 200,210 | - |
| Big Suamico | 64,525 | 46,905 | 111,430 | 1.4 |
| Burns Waterway | 0 | 4,282,503 | 4,282,530 | - |
| Calumet H. & R. | 7,241,529 | 14,113,323 | 21,354,852 | 0.5 |
| Chicago Harbor | 299,192 | 302,687 | 601,879 | 1.0 |
| Chicago River | 2,616,419 | 0 | 2,616,419 | - |
| Gladstone-Kipling | 0 | 238,782 | 238,782 | - |
| Green Bay | 5,361,078 | 9,918,981 | 15,280,057 | 0.5 |
| Indiana | 5,286,346 | 3,708,074 | 8,994,420 | 1.4 |
| Kenosha | 977,292 | 305,723 | 1,283,015 | 3.2 |
| Kewaunee | 1,514,248 | 419,429 | 1,933,677 | 3.6 |
| Manitowoc | 1,311,635 | 501,802 | 1,813,437 | 2.6 |
| Menominee | 1,197,664 | 246,421 | 1,444,085 | 4.9 |
| Michigan City | 1,247,349 | 302,673 | 1,550,022 | 4.1 |
| Milwaukee | 1,376,628 | 4,399,995 | 5,776,623 | 0.3 |
| Oconto | 189,818 | 0 | 189,818 | - |
| Pensaukee | 43,548 | 82,795 | 126,343 | 0.5 |
| Port Washington | 402,561 | 288,836 | 691,397 | 1.4 |
| Racine | 1,185,448 | 174,755 | 1,360,203 | 6.8 |
| Sheboygan | 1,636,601 | 810,860 | 2,447,461 | 2.0 |
| Sturgeon Bay/ Ship Canal | 2,071,014 | 1,393,348 | 3,464,362 | 1.5 |
| Two Rivers | 2,176,515 | 149,460 | 2,325,975 | 14.6 |
| Waukegan | 1,099,636 | 40,274 | 1,139,910 | 27.3 |
| District totals | 37,499,254 | 41,727,626 | 79,226,880 | |

Table 42. (continued)

| Public harbors | Maintenance | New work | Totals | M/NW ratio |
|---|---|---|---|---|
| Detroit District | | | | |
| Arcadia | 0 | 0 | 0 | - |
| Charlevoix | 230,165 | 4,505 | 234,670 | 51.1 |
| Frankfurt | 680,400 | 379,529 | 1,059,929 | 1.8 |
| Grand Haven | 7,101,322 | 989,464 | 8,090,786 | 7.2 |
| Grays Reef | 306,060 | 0 | 306,060 | - |
| Holland | 2,131,571 | 841,492 | 2,973,063 | 2.5 |
| Leland | 68,884 | 33,744 | 102,628 | 2.0 |
| Ludington | 954,219 | 93,510 | 1,047,729 | 10.0 |
| Manistee | 1,551,017 | 386,293 | 1,937,310 | 4.0 |
| Manistique | 399,839 | 255,967 | 625,806 | 1.8 |
| Muskegon | 1,408,822 | 572,925 | 1,981,747 | 2.5 |
| Pentwater | 912,020 | 0 | 912,020 | - |
| Petoskey | 0 | 0 | 0 | - |
| Portage Lake | 196,374 | 0 | 196,374 | - |
| Saugatuck | 1,255,141 | 0 | 1,255,141 | - |
| South Haven | 1,812,306 | 52,025 | 1,864,331 | 34.8 |
| St. James | 0 | 0 | 0 | - |
| St. Joseph | 2,487,957 | 234,484 | 2,731,441 | 10.2 |
| Traverse City | 0 | 0 | 0 | - |
| White Lake | 936,494 | 0 | 936,494 | - |
| District totals | 22,432,591 | 3,822,938 | 26,255,529 | |
| Totals for lake | 59,931,845 | 45,550,564 | 105,482,409 | |

Table 43. AVERAGE ANNUAL PRIVATE, MAINTENANCE, AND NEW WORK DREDGING IN LAKE MICHIGAN BY C.E. DISTRICT, 1961-1970 (50, 52)
(cubic yards)

| | Chicago District | Detroit District | Total | Percent of grand total |
|---|---|---|---|---|
| Private | 636,200 | 114,600 | 750,800 | 18 |
| Maintenance | 878,800 | 602,600 | 1,481,400 | 35 |
| New work | 1,878,500 | 115,200 | 1,993,700 | 47 |
| Totals | 3,393,500 | 832,400 | 4,225,900 | 100 |

dredging volume, 18 percent of the grand total, is relatively large due to the high permit dredging during the early 1960's in Calumet, Chicago, and Indiana Harbors. However, the C.E. reported that Section 10 permit dredging accounts for only 10 percent of the total annual volume in the Great Lakes (1).

During the base period (1961-1970), maintenance dredging has averaged 1.5 million cubic yards, whereas new work dredging has average 2.0 million cubic yards. Approximately 60 percent of the maintenance and 94 percent of the new work dredging took place in the Chicago District. The average new work dredging volume was relatively high, reflecting the construction of Burns Waterway Harbor and the deepening and/or expansion of Calumet, Chicago, Green Bay, Indiana, Kenosha, and Milwaukee Harbors.

In Table 44, the average annual private, maintenance, and new work dredging quantities are listed by harbor for each C.E. district. Although the private dredging data are not complete, the table does indicate those harbors with high permit dredging. Dredging quantities from private recreational harbors, such as Wilmette Harbor, Illinois, and quantities removed by power generating companies, for example Consumer's Power in the Detroit District, are included in the 'Miscellaneous sites' data.

Table 44. AVERAGE ANNUAL PRIVATE, MAINTENANCE, AND NEW WORK DREDGING IN LAKE MICHIGAN BY HARBOR 1961-1970 (50, 52)
(cubic yards)

| Chicago District | Private | Maintenance | New work | Totals |
|---|---|---|---|---|
| Public harbor | | | | |
| Algoma | 0 | 830 | 0 | 830 |
| Big Suamico | 0 | 2,130 | 0 | 2,130 |
| Burns Waterway | 0 | 0 | 428,250 | 428,250 |
| Calumet H. & R. | 187,880 | 198,680 | 737,280 | 1,123,840 |
| Chicago Harbor | 97,910 | 830 | 29,640 | 128,380 |
| Chicago River | 10,800 | 68,590 | 0 | 79,390 |
| Gladstone-Kipling | 0 | 0 | 23,880 | 23,880 |
| Green Bay | 620 | 117,150 | 140,220 | 257,990 |
| Indiana | 221,930 | 137,180 | 78,570 | 437,680 |
| Kenosha | 1,180 | 15,360 | 23,870 | 40,410 |
| Kewaunee | 1,350 | 39,590 | 13,250 | 54,190 |
| Manitowoc | 1,200 | 35,950 | 0 | 37,150 |
| Menominee | 490 | 8,910 | 1,860 | 11,260 |
| Michigan City | 0 | 40,930 | 2,260 | 43,190 |
| Milwaukee | 34,830 | 41,800 | 394,830 | 471,460 |
| Oconto | 0 | 3,530 | 0 | 3,530 |
| Pensaukee | 0 | 2,030 | 0 | 2,030 |
| Port Washington | 5,400 | 7,720 | 0 | 13,120 |
| Racine | 0 | 17,510 | 0 | 17,510 |
| Sheboygan | 0 | 33,090 | 0 | 33,090 |
| Sturgeon Bay/ Ship Canal | 3,410 | 42,230 | 0 | 45,640 |
| Two Rivers | 0 | 43,490 | 1,070 | 44,560 |
| Waukegan | 6,810 | 21,280 | 3,480 | 51,970 |
| Totals | 573,810 | 878,810 | 1,878,460 | 3,351,480 |
| Private harbor | | | | |
| Buffington | 0 | - | - | 0 |
| Escanaba | 0 | - | - | 0 |
| Gary | 11,000 | - | - | 11,000 |
| Oak Creek | 5,000 | - | - | 5,000 |
| Miscellaneous sites | 46,400 | - | - | 46,400 |
| Totals | 62,400 | | | 62,400 |
| District totals | 636,210 | 878,810 | 1,878,460 | 3,413,880 |

Table 44. (continued)

| Detroit District | Private | Maintenance | New work | Totals |
|---|---|---|---|---|
| Public harbors | | | | |
| Arcadia | 6,300 | 0 | 0 | 6,300 |
| Charlevoix | 0 | 6,410 | 0 | 6,410 |
| Frankfurt | 0 | 18,690 | 15,020 | 33,710 |
| Grand Haven | 4,860 | 146,390 | 0 | 151,250 |
| Grays Reef | 0 | 30,610 | 0 | 30,610 |
| Holland | 0 | 74,560 | 0 | 74,560 |
| Leland | 0 | 570 | 3,370 | 3,940 |
| Ludington | 5,550 | 24,210 | 0 | 29,760 |
| Manistee | 0 | 27,450 | 21,880 | 49,330 |
| Manistique | 0 | 9,950 | 21,130 | 31,080 |
| Muskegon | 2,140 | 38,820 | 48,630 | 89,590 |
| Pentwater | 0 | 37,420 | 0 | 37,420 |
| Petoskey | 0 | 0 | 0 | 0 |
| Portage Lake | 0 | 8,920 | 0 | 8,920 |
| Saugatuck | 0 | 48,220 | 0 | 48,220 |
| South Haven | 0 | 46,320 | 5,200 | 51,520 |
| St. James | 620 | 0 | 0 | 620 |
| St. Joseph | 0 | 59,450 | 0 | 59,450 |
| Traverse City | 0 | 0 | 0 | 0 |
| White Lake | 0 | 24,580 | 0 | 24,580 |
| Totals | 19,470 | 602,570 | 115,230 | 737,270 |
| Private harbors | | | | |
| Petoskey Penn Dixie | 0 | - | - | 0 |
| Port Inland | 0 | - | - | 0 |
| Miscellaneous sites | 95,080 | - | - | 95,080 |
| Totals | 95,080 | | | 95,080 |
| District totals | 114,550 | 602,570 | 115,230 | 832,350 |
| Totals for lake | 750,760 | 1,481,380 | 1,993,690 | 4,225,830 |

Harbors with over 100,000 cubic yards of average annual maintenance dredging include Calumet, Grand Haven, Green Bay, and Indiana. The average annual maintenance dredging quantities listed in this study are 19 percent lower than averages calculated by the C.E. Part of this difference is accounted for in the conversion of all dredging volume data in this report to place measure. The remainder may be explained by a safety margin allowed for by the C.E. in their data.

Average annual new work dredging quantities are not useful statistics except to indicate the quantity of new work that took place during the base period. Moreover, future new work dredging quantities cannot be predicted on the basis of previous new work dredging.

## Future Dredging Quantities

Future private and maintenance dredging quantities have been projected by harbor in each Corps of Engineers' district as indicated in Table 45. Future annual private dredging volumes are based on averages of the 1963 through 1973 dredging records for each harbor. In the Chicago District, only Calumet and Indiana Harbors should require relatively high average annual private dredging, while moderate permit dredging will probably take place in Manitowoc, Milwaukee, and Racine Harbors. In the Detroit District, little permit dredging, except for miscellaneous areas, is anticipated. Miscellaneous permit dredging sites include private recreational harbors and coastal areas where municipalities, power generating companies, and others may have dredging performed.

Future average annual maintenance dredging projections were determined by averaging the maintenance dredging quantities of the past several years, then modified by consideration of special circumstances. For example, in Indiana Harbor the project depth was extended to 27 feet in 1963, therefore the projection of future average annual maintenance dredging was based on the period 1964 to the present. Some harbors, such as Sheboygan, did not undergo new work dredging during the past

Table 45. FUTURE AVERAGE ANNUAL PRIVATE AND MAINTENANCE DREDGING VOLUMES IN LAKE MICHIGAN BY C.E. DISTRICT (1, 50, 52)
(cubic yards)

| Chicago District | Private dredging | Maintenance dredging | Base period for maintenance | C.E. maintenance dredging |
|---|---|---|---|---|
| Public harbor | | | | |
| Algoma | 0 | 1,400 | 1945-1964 | 3,000 |
| Big Suamico | 0 | 2,700 | 1959-1966 | 5,000 |
| Burns Waterway | 0 | 30,000 | By C.E. | 30,000 |
| Calumet H. & R. | 193,800 | 113,800 | 1967-1973 | 200,000 |
| Chicago Harbor | 400 | 6,900 | 1951-1961 | 59,000 |
| Chicago River | 5,100 | 77,500 | 1958-1967 | 49,000 |
| Gladstone-Kipling | 0 | 3,000 | By C.E. | 3,000 |
| Green Bay | 7,000 | 156,100 | 1967-1973 | 137,000 |
| Indiana | 187,500 | 97,200 | 1964-1973 | 151,000 |
| Kenosha | 0 | 20,000 | 1966-1970 | 29,000 |
| Kewaunee | 2,800 | 38,000 | 1965-1970 | 28,000 |
| Manitowoc | 8,200 | 36,900 | 1963-1970 | 35,000 |
| Menominee | 500 | 7,900 | 1956-1966 | 15,000 |
| Michigan City | 0 | 36,100 | 1964-1973 | 48,000 |
| Milwaukee | 19,600 | 53,200 | 1965-1969 | 70,000 |
| New Buffalo[a] | 600 | 10,000 | By C.E. | 10,000 |
| Oconto | 0 | 2,200 | 1949-1964 | 3,000 |
| Pensaukee | 0 | 1,400 | 1952-1966 | 2,100 |
| Port Washington | 5,400 | 5,900 | 1962-1972 | 15,000 |
| Racine | 12,100 | 21,900 | 1961-1968 | 30,000 |
| Sheboygan | 0 | 33,100 | 1961-1970 | 23,000 |
| Sturgeon Bay/Ship Canal | 6,800 | 42,200 | 1961-1970 | 50,000 |
| Two Rivers | 0 | 40,100 | 1964-1973 | 51,000 |
| Waukegan | 6,800 | 25,000 | 1961-1969 | 32,000 |
| Washington Island[a] | 1,300 | 0 | - | 0 |
| Totals | 447,900 | 862,500 | | 1,078,100 |
| Private harbor | | | | |
| Buffington | 1,500 | | | |
| Escanaba | 0 | | | |
| Gary | 3,500 | | | |
| Oak Creek | 5,000 | | | |
| Miscellaneous sites | 76,200 | | | |
| Total | 86,200 | | | |
| District totals | 534,100 | 862,500 | | 1,078,100 |

Table 45. (continued)

| Detroit District | Private dredging | Maintenance dredging | Base period for maintenance | C.E. maintenance dredging |
|---|---|---|---|---|
| Public harbors | | | | |
| Arcadia | 6,300 | 0 | - | None required |
| Charlevoix | 0 | 6,100 | 1963-1972 | 30,000 |
| Frankfurt | 0 | 23,100 | 1963-1973 | 32,000 |
| Grand Haven | 5,000 | 130,800 | 1964-1973 | 100,000 |
| Grays Reef | 0 | 21,900 | 1960-1973 | 16,000 |
| Holland | 0 | 73,700 | 1964-1973 | 105,000 |
| Leland | 0 | 12,600 | 1969-1973 | 15,000 |
| Ludington | 7,000 | 31,600 | 1966-1973 | 55,000 |
| Manistee | 0 | 34,800 | 1965-1973 | 55,000 |
| Manistique | 0 | 11,900 | 1965-1972 | 40,000 |
| Muskegon | 1,300 | 49,200 | 1966-1973 | 105,000 |
| Pentwater | 0 | 42,500 | 1964-1973 | 70,0000 |
| Petoskey | 0 | 0 | - | None required |
| Portage Lake | 0 | 16,000 | 1963-1973 | 40,000 |
| Saugatuck | 0 | 50,300 | 1964-1973 | 55,000 |
| South Haven | 0 | 40,000 | 1964-1973 | 74,000 |
| St. James | 1,000 | 1,500 | By C.E. | 1,500 |
| St. Joseph | 0 | 54,900 | 1964-1973 | 80,000 |
| Traverse City | 0 | 1,500 | By C.E. | 1,500 |
| White Lake | 0 | 26,500 | 1964-1973 | 60,000 |
| Totals | 20,600 | 628,900 | | 935,000 |
| Private harbors | | | | |
| Petoskey Penn Dixie | 0 | | | |
| Port Inland | 0 | | | |
| Miscellaneous sites | 180,000 | | | |
| Total | 180,000 | | | |
| District totals | 200,600 | 628,900 | | 935,000 |
| Totals for lake | 734,700 | 1,491,400 | | 2,013,100 |

[a]New harbor to be constructed.

decade. Their projection was based on a 10-year period beginning with the year of the last maintenance dredging project. Since some of the smaller harbors, for example, Oconto Harbor, were not dredged for several years, the base period for the projection had to be extended back beyond the past decade. Projected volumes for Green Bay, Ludington and Milwaukee include an additional 10 percent because of new work projects scheduled for these harbors.

Since no historical maintenance dredging quantities were indicated in the C.E. records for Burns Waterway, Gladstone-Kipling, New Buffalo, St. James, and Traverse City, projections made by the C.E. were accepted for these harbors. Some shoaling is projected to occur in New Buffalo Harbor even though it has not yet been expanded into a new public recreational harbor. Shoaling problems in Burns Waterway are not expected to develop for another 3 to 4 years.

Although a correlation factor between annual maintenance dredging volumes and mean annual lake levels of Lake Michigan was determined to be -0.58, this relationship was not built into the projection because lake levels are unpredictable (see Section VI). When lake levels are low, to prevent groundings, the C.E. stringently maintains the commercial harbors at project depths plus 1 to 2 feet of subgrade. Because dredging is performed with regard to the mean low-water datum, during high lake levels maintenance dredging in some harbors may be temporarily postponed, even though some shoaling has occurred.

The future average annual maintenance dredging volume for Lake Michigan has been projected to be 1,491,400 cubic yards place measure, or nearly equal to the average of the 1961 through 1970 period (Table 43). Compared to the long-term average (1935-1973), which was calculated to be 1,211,300 cubic yards, future maintenance dredging quantities should increase by 280,000 cubic yards annually. Thus, a small future annual increase is projected. Several new harbors, for example Burns Waterway, will require maintenance dredging. A few harbors, such as Green Bay and

Milwaukee, may have slightly larger dredging requirements due to new work projects. This increase should be partially offset by a reduction of dredging in some industrialized harbors, such as Indiana and Calumet Harbors, where man-made sedimentation is decreasing.

Drawing on their experience with individual harbors, the C.E. has estimated future average annual maintenance dredging volume in Lake Michigan to be 2,013,100 cubic yards (Table 45). These projected quantities represent maximum dredging volumes, which would be dredged provided that no funding limitations, disposal site availability, or other constraints are imposed. Compared to the Corps of Engineers' projection, future average annual maintenance dredging volume calculated in this study is 525,100 cubic yards less or 26 percent lower. However, a Chi-square analysis revealed no significant difference, at the .01 level, between the two projections.

In the Chicago District, with the exception of Calumet, Indiana, Menominee, and Port Washington Harbors, there is only general correspondence between the two projections. Because dredging volumes are small in Menominee and Port Washington, differences between the two projections are insignificant. Big Suamico Harbor may not undergo maintenance dredging in the future as this project is no longer economically justified. Due to the effect of pollution elimination systems on industrial and municipal sedimentation (Public Law 92-500), harbors such as Calumet, Chicago, and Indiana will probably exhibit slightly lower maintenance dredging requirements than that projected by the C.E. As much as 75 percent of the spoil volume dredged from Calumet Harbor and River may be comprised of industrial wastes.

With regard to the Detroit District, less correspondence exists between the projection of this study and that of the C.E. for future average annual maintenance dredging. Specifically, large differences are noted for Charlevoix, Manistique, Portage Lake and White Lake, with moderate disparities for Ludington, Muskegon and South Haven Harbors. Conversion

of the dredging volumes from bin measure to place measure probably accounts for some of the difference. At Muskegon Harbor the breakwater is relatively new; thus, sediments from littoral transport may not accumulate in the outer harbor for a couple of years. Therefore, future annual maintenance dredging at Muskegon may exceed the average of the past decade.

Conversely, recent dredging histories of Charlevoix, Manistique, and Portage Lake do not substantiate the Corps of Engineers' projection for these harbors. Moreover, due to a long-term decline in commerce and increasing recreational activities, some small harbors such as Pentwater, Portage Lake, Saugatuck and White Lake may, in the future, be dredged only to a depth of 12 to 14 feet instead of being maintained at their present project depth of 18 to 24 feet.

New work dredging projects currently planned by the C.E. for Lake Michigan are listed in Table 46. Because all 9 of these federal projects may not receive final authorization and funding, the list should be regarded as a maximum new work projection. Construction of the New Buffalo Harbor was scheduled to begin September, 1973 with completion in 1974-75. No data were collected regarding construction of new private harbors, however there is a trend away from private harbors.

All of the new public harbors scheduled for construction will be recreational harbors and as such should generate small volumes of additional future maintenance dredging. New work projects in Green Bay, Ludington and Milwaukee harbors are expected to cause a small increase in annual maintenance dredging. Usually, this increase in maintenance dredging occurs during the first few years following channel deepening or widening as the walls of these new channels slough in due to vessel traffic and effect of bow thrusters.

Summary

In summary, a historical total of 118.7 million cubic yards have been

Table 46. FUTURE NEW WORK DREDGING PROJECTS IN PUBLIC HARBORS OF LAKE MICHIGAN BY C.E. DISTRICT (50, 52)
(cubic yards)

| Project | Volume to be dredged | Completion date of project |
|---|---|---|
| Chicago District | | |
| Cedar River[a] | 50,600 | 1976 |
| Green Bay | 603,000 | 1976-77 |
| Illinois Beach State Park[a] | 100,000 | 1976-77 |
| Milwaukee | 1,535,000 | 1977 |
| New Buffalo[a] | 67,000 | 1974-75 |
| Northport[a] | 1,310,000 | 1977-79 |
| Port Washington | 20,000 | 1975-76 |
| Total | 3,685,600 | |
| Detroit District | | |
| Cross Village[a] | 42,200 | 1979 |
| Ludington | 695,000 | 1977 |
| Total | 737,200 | |
| Total for lake | 4,422,800 | |

[a]New public harbor to be constructed.

dredged from private and public harbors of Lake Michigan. During the past decade (1961-1970), an annual average of 3,042,000 cubic yards were removed from these harbors. Private dredging volumes accounted for 18 percent of this average total, while maintenance and new work dredging amounted to 35 and 47 percent, respectively. The largest quantities of spoil are derived from Calumet, Chicago Harbor and River, Grand Haven, Green Bay, and Indiana Harbors. Excluding Grand Haven, these public commercial harbors with high maintenance dredging requirements are characterized by 27-foot seaway channels and are part of industrial-urban complexes.

For the next decade, the future average annual dredging volume in Lake Michigan has been estimated to be 2,963,200 cubic yards. Private dredging volumes will probably continue to be quite high, i.e., about 735,000 cubic yards, which is 25 percent of the total annual quantity. The projected volume of average annual maintenance dredging is 1.5 million cubic yards, a quantity similar to that of the 1961-1970 period. Should the water level of Lake Michigan drop suddenly during the next decade, the annual maintenance dredging volume may slightly exceed this projection. Conversely, if confined disposal sites are not available for those public harbors which are considered polluted, maintenance dredging may have to be postponed in some harbors until acceptable methods of disposal are found. Future new work dredging volumes are expected to average 737,100 cubic yards annually, a relatively low figure when compared to the 1961-1970 period or to the long-term average (1935-1973). Six of the 9 new work projects scheduled by the C.E. concern the construction of new recreational harbors while only 3 projects involve deepening of existing commercial harbors.

## DREDGING QUANTITIES IN LAKE SUPERIOR

Dredging activity in Lake Superior dates from the early 1900's. In the early days harbor improvement projects were largely expediency projects,

assigned to those harbors where shoaling restricted the free movement of ships. Few detailed records were kept and dredge spoils were dumped in the open lake. The Canadian harbors were primarily opened and developed to serve the lumbering industry and later the paper industry. As the steel industry placed more and more demand upon shipping, ship drafts increased requiring deeper harbors and waterways. Ship lengths and beams increased, which required more adequate berthing space as well as enlarged turning basin and anchorage facilities. Parallel developments of harbor facilities can be traced in the ports of the "copper country." As copper mining declined and the lumbering industry closed down, the harbors of Lake Superior have consolidated activities. Some of the smaller ports have been relegated to recreational use and some still maintain a small fishing trade (Figure 10).

Changes in principal use and trade patterns of the upper Great Lakes dictated alterations in the dredging requirements and frequencies. During the earlier years of Lake Superior's waterborne trade and harbor maintenance, the C.E. operated from an office in Duluth, Minnesota. In 1955, the Duluth office was closed and moved to a consolidated operation in the St. Paul District at St. Paul. In preparation for the consolidation of activities in St. Paul some of the old records of the Duluth office were destroyed. Therefore, historic dredging records, in particular the permit files, are generally not available prior to 1955. The history of dredging activity can be gleaned with increasing detail and accuracy primarily from the annual reports of the C.E. Early reports cited only the total expenditures of the district without regard to activity. During the 1930's the annual reports began to itemize expenditures for certain activities, however, dredging if listed was commonly shown only as a lump dollar sum. During the 1940's, dredge activities began to be reported in cubic yards and in the middle 1950 period a distinction was being made between maintenance and new work dredging volumes. Annual reports of the C.E. Districts have never recorded the volume of permit dredging, inasmuch as these activities are privately

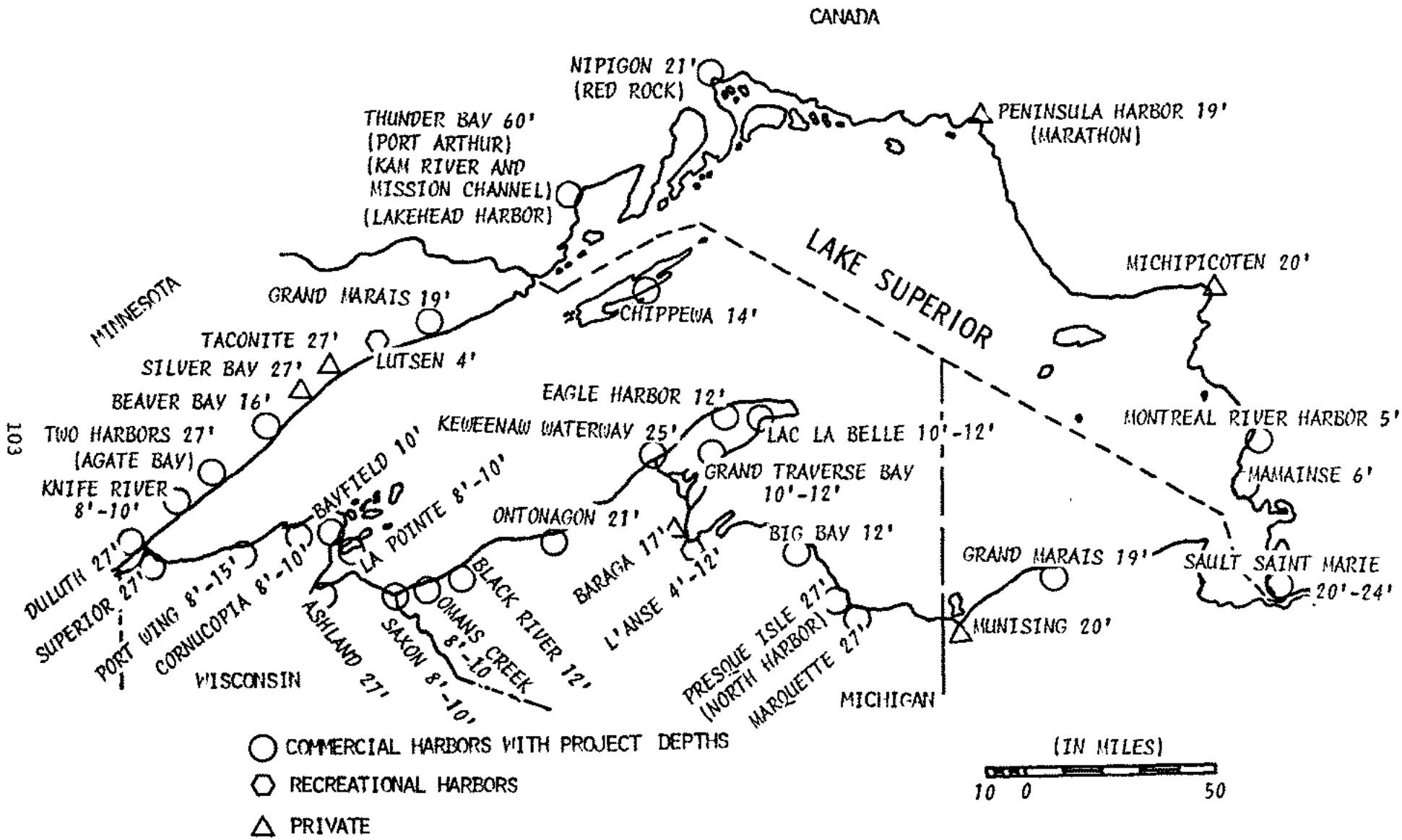



Figure 10. CLASSIFICATION AND PROJECT DEPTHS OF HARBORS IN LAKE SUPERIOR

funded and are not the fiscal responsibility of the C.E. Inasmuch as private dredging in the navigable waters of the Great Lakes requires the approval of the C.E., applications to dredge are filed in the C.E. office after approval. These are available for scrutiny, however all types of permit work in navigable waters are filed together in accession number order by year. In general, current policy of the St. Paul District indicates that the permit files may be destroyed 2 years after date of application. Although the files of the St. Paul District are reasonably intact since 1955, space limitations may dictate their destruction at any time.

Dredging problems in Lake Superior are somewhat unique to the other Great Lakes. Bottom gradients are generally steep within the nearshore area and commonly bedrock based or composed of unsorted glacial till. Dredging is almost universally limited to dipper or clam shell work for boulder and bedrock removal. For this reason of bottom configuration, longshore drift or littoral current transfer is of little consequence to harbor maintenance.

The major dredging problem in the Lake Superior harbors is tied directly to ice-shove and ice rafting during winter storms. Bottom profiles show submarine benching of sands caused by storms of different intensity. Soundings made by the C.E. show that the development of benches at various depths are directly caused by the winter storms. This is particularly true of the "long fetch harbors" exposed to the prevailing NW winter storms. The sheltered harbors show virtually no effect. These can be roughly summarized as:

| LONG FETCH--NW | | Protected of Lee Harbors |
|---|---|---|
| Port Wing | Marquette | All north shore harbors |
| Cornucopia | Munising | Duluth--Superior |
| Saxon | Grand Marais, Michigan | Bayfield |
| Black River | All Whitefish Bay (Sault entry) | LaPointe |
| Ontonagon | | Ashland |
| West Keweenaw Entry | | Lac La Belle |
| Eagle | | Grand Traverse |
| | | Chippewa |

Occasional NE storms in winter are very severe and, with a frequency of one in 10 years, very easily upset ALL THE PLANNING OF TEN YEARS for harbor maintenance. No dredging frequency can even be attempted in most exposed harbors because they are at the mercy of the storms. Those harbors most susceptible to NE severe storms are those opening to the NE, such as: L'Anse, Marquette, Grand Marais (Michigan), Duluth-Superior, Big Bay and Bayfield.

Dredging frequency is directly related to:

1. Storm azimuth
2. Wind velocity
3. Thickness of ice
   Low mean winter temperatures
4. Bottom gradient
5. Nature of bottom sediments vs. azimuth
6. Nature of harbor basement
7. Stream mouth harbor vs. "pocket harbor"
8. Stream flow regimen in harbor
9. Storm frequency by azimuth

Alternatively, an off-azimuth storm of high intensity may clean-out 10 years of sediment accumulation in a period of a few hours in a summer storm and completely negate all dredging plans. Bayfield and North Coast Harbors are good examples of the effects of freak SE storms of high intensity.

The C.E. finds that seiche patterns in the harbors are more critical in sediment control and in shipping hazards than stream flows and normal winds. Most of the larger harbors have seiche reporting services for the pilots and use seiche-lights at the entries and breakwaters. They show by colored lights the state of the 'tide' and current velocities. Harbor pilot advisories notify skippers and pilots of dangerous ebb and flow conditions. Normal seiches on the long fetch coastline combined with wide barometric differences over Lake Superior cause more sediment transfer than any other factors except severe storms.

A Reach Map of Lake Superior (7), shows the Reaches of the shorelines set into categories determined by fetch, storm frequencies and littoral

current direction. Each category essentially presents a similar set of conditions for all harbors within the Reach. In Lake Superior the Reaches are numbered in the 9000 series. All other lakes have been likewise subdivided with appropriate Reach numbers. Using that map in conjunction with the Fetch Chart of wind directions (Table 11-28) (7) for the 9000 series Reaches, it is possible to determine the wind azimuths which provide the significant sediment transfer effects. Deep Water Wave Forecasting Curves (Fig. 11-39) (7) give a concept of wave intensity--height values possible at harbors within each Reach. These observations combined with a wind rose analysis at stations around the Great Lakes demonstrates the effect of prevailing and storm winds on harbor maintenance problems. Charts #54 and 55 from the Canadian Climatological Studies report (8) illustrate the frequency, direction and intensity of winds as they may be correlated with the fetch data. January and April are used here to illustrate winds which most effect the movement of ice. January represents the early ice forming period when shore ice is most mobile and has local effect. April wind rose charts show the period of average ice decay when the shore effect is expected to be the greatest. The predominance of westerlies in winter and an increase in easterlies in spring is a notable feature.

## United States Maintenance Dredging History

Based upon dredging records since 1937, a total of 30 U.S. harbors have been dredged at least once. During the 36 years of record, an average of 4.1 harbors are dredged each year for maintenance. In the representative sample period of 10 years (1961-1970), maintenance dredging was performed on an average of 4.8 harbors per year. The number of projects per year ranged from 2 to 6 during the 36-year period, and from 3 to 6 during the 10-year sample period. Peak maintenance years appeared in 1939, 1945, 1948, 1951, 1961, 1966 and 1970-1972 (Table 47).

Table 47. HISTORICAL ANNUAL MAINTENANCE AND NEW WORK DREDGING IN LAKE SUPERIOR, 1937-1972 (48, 49, 53)
(cubic yards)

| Fiscal year | Maintenance | No. harbors | New work | No. harbors | Private |
|---|---|---|---|---|---|
| 1972 | 97,830 | 5 | 290,548 | 8 | 63,500 |
| 1971 | 132,280 | 4 | 142,035 | 9 | 7,850 |
| 1970 | 304,115 | 4 | 20,575 | 3 | 6,000 |
| 1969 | 250,684 | 5 | 5,985 | 2 | 76,000 |
| 1968 | 196,077 | 3 | 40,000 | 1 | 1,165,610 |
| 1967 | 152,860 | 4 | 275,661 | 2 | 63,000 |
| 1966 | 164,688 | 6 | 12,675 | 1 | 0 |
| 1965 | 168,649 | 5 | 417,080 | 1 | 22,800 |
| 1964 | 77,085 | 5 | 1,902,164 | 3 | 780,000 |
| 1963 | 69,794 | 5 | 3,208,387 | 6 | 0 |
| 1962 | 228,745 | 5 | 292,919 | 4 | 0 |
| 1961 | 144,190 | 5 | 129,520 | 3 | 200,000 |
| 1960 | 115,456 | 4 | 289,121 | 5 | 40,000 |
| 1959 | 225,507 | 4 | 50,300 | 1 | 0 |
| 1958 | 180,184 | 4 | 85,571 | 5 | 0 |
| 1957 | 423,774 | 3 | 32,850 | 1 | 0 |
| 1956 | 250,664 | 5 | 555,058 | 2 | 0 |
| 1955 | 326,345 | 3 | 480,932 | 1 | 0 |
| 1954 | 248,314 | 2 | 0 | 0 | 0 |
| 1953 | 335,498 | 4 | 32,732 | 1 | 0 |
| 1952 | 319,738 | 4 | 18,774 | 2 | 0 |
| 1951 | 450,916 | 5 | 87,281 | 3 | 0 |
| 1950 | 238,155 | 4 | 150,022 | 2 | 0 |
| 1949 | 246,924 | 4 | 14,214 | 1 | 0 |
| 1948 | 285,646 | 6 | 52,182 | 1 | 0 |
| 1947 | 285,112 | 5 | 0 | 0 | 0 |
| 1946 | 278,919 | 3 | 0 | 0 | 0 |
| 1945 | 452,602 | 5 | 0 | 0 | 0 |
| 1944 | 68,920 | 2 | 0 | 0 | 0 |
| 1943 | 111,073 | 3 | 0 | 0 | 0 |
| 1942 | 12,935 | 1 | 0 | 0 | 0 |
| 1941 | 328,556 | 3 | 33,585 | 1 | 0 |
| 1940 | 396,372 | 3 | 1,898,825 | 2 | 0 |
| 1939 | 7,658,554 | 6 | 5,236,617 | 8 | 420,795 |
| 1938 | 0 | 0 | 29,910 | 1 | 0 |
| 1937 | 1,931,122 | 1 | 285,977 | 1 | 0 |
| Prior | 92,237 | 2 | 53,676,746 | 4 | 0 |
| Totals | 17,250,520 | | 69,749,246 | | 2,842,555 |

| | |
|---|---|
| U.S. grand total: | 89,842,321 |
| Canadian grand total: | 3,888,718 |
| Total for lake: | 93,731,039 |

Maintenance dredging in Lake Superior by the C.E. throughout the historic period of dredging records (1937-1972) totals 17,250,520 CY. This represents 19.1 percent of all U.S. dredging during the period and 18.3 percent of the total dredging in Lake Superior (Canada included) in all categories.

During the 10-year sample period (1961-1970) maintenance dredging within U.S. harbors in Lake Superior totaled 1,594,742 CY. This represents 15 percent of the total (10,611,464 CY) in all categories. On the basis of the 10-year representative sample, annual maintenance dredging may be projected to be approximately 160,000 CY annually for the next 10 years. It is recognized that dredging volumes have decreased materially in the last 10 to 15 year period, as explained elsewhere in this report. Therefore, an analysis of annual maintenance dredging volumes of Lake Superior from 1940 to the present may provide a viable average annual figure. The starting year 1940 is selected in order to eliminate the unusually high volume year of 1939, in which 7,658,554 CY were removed from U.S. harbors. Average annual dredging volume in the 33-year period is 238,268 CY.

A reasonable prediction for the next 10 years would then range from 160,000 to 238,000 CY or approximately 200,000 CY annually. This figure of course does not consider the constraints of pollution abatement, disposal site problems, commerce patterns and lake levels.

United States New Work--

During the 36-year record period an average of 2.3 harbors were committed to new work development, whereas in the 10-year sample period an average of 2.5 harbors were expanded or deepened. New work frequencies range from 0 to 9 harbors per year over the historical sequence and from 0 to 6 during the 10-year sample period. Years showing no new work included the World War II period of 1942 to 1944, and 1946, 1947, 1954,

and 1966. Peak years of new work activity occurred in 1939, 1962 and 1963, and in 1971 and 1972 (Table 47).

New work dredging during the historic period (1937-1972), by the C.E. totals 69,749,246 CY. This represents 74 percent of all historic U.S. dredging. This figure, however, includes a "prior years" total of 53,676,746 CY, representing the early years of development of the Lake Superior projects. The largest individual "new work year" was 1939, when 5,236,617 CY were dredged. Eliminating the "prior years" total, new work dredging since 1937 is indicated as 16,072,500 CY or an average annual rate of 446,458 CY for 36 years.

The representative 10-year total of new work is 6,304,966 CY, which is an annual average rate of 630,496 CY. This figure, however, includes 2 very high volume years. In 1963 and 1964, approximately 5.1 million cubic yards were extracted in development work. A more realistic mean value can be determined for this 10-year period by adding the 8 other years, dividing by 8, to yield 149,301 CY/year. Averages during this test period of 10 years are of little significance, inasmuch as the low volume of 5,985 CY (1969), for example, averages in with 3,209,387 CY (1963). The most realistic predictions can probably be made by comparing long term averages over 36 years of record with this erratic activity period of 10 years. The 36-year average of approximately 446,000 CY is close to a mean value between the adjusted 10 years (150,000 CY) and the unadjusted same average (630,000 CY). The mean of these 2 values is 390,000 CY.

A 10-year prediction for average annual new work should range between 390,000 CY and 446,000 CY, depending upon plans and budget appropriations for new facilities. An average of these 2 values is 418,000 CY per year. Such a figure is strictly a statistical average of long term performance. No new work is scheduled for Lake Superior at this time. A potential project in Duluth-Superior Harbor has been publicized to develop 225 acres on St. Louis Bay as a coal loading facility, costing

$25,000,000 (9). Plans call for the filling of existing slips west of the Burlington Northern grain elevators. Although no comment has been made regarding the source of fill material, it is presumed that some will be dredge spoil. As of February 1974, no application for a Section 10 permit had been filed with the E.P.A. in Chicago or the C.E. in St. Paul.

United States Permit Work--

The paucity of records on permit dredging limits interpretation of patterns of activity during the 36-year term. More complete records for the later part of the 10-year sample, suggest that at least one permit is issued per year with 1968 showing the issuance of 4 permits. These were granted for Baraga, Duluth-Superior, Keweenaw Waterway, and Presque Isle. In 1972, private interests received permits to dredge in Duluth-Superior, Oman's Creek, Presque Isle and Two Harbors. Volumetric averages and totals have been determined using those years of record available in the C.E. St. Paul District files.

During the historic period of 1937 to the present, private operators moved a minimum of 2,842,555 CY. Considerably more than this may have been dredged. From 1940 to 1960, no private dredging is recorded, which appears to be an unlikely operational fact. The 2.8 million cubic yards of record is 3 percent of the total volume of dredge spoils handled during the historic period.

The 10-year sample period (1961-1970) probably reveals a more complete record of activity, volume and frequency for projection purposes. The volume of spoil moved by private interests between 1961 and 1970 totaled 2,313,410 CY or 22 percent of the dredging in this period (10,375,263 CY) (Table 47).

An annual average projection for the next 10 years, amounting to 231,000 CY appears to be unrealistic, inasmuch as this figure includes a 1.6 million CY year averaged with 3 years of no activity. A selected-year

grouping may be more representative of this 10-year sample. Elimination of the 1968 high volume year (1.16 million CY) and the "no activity" years of 1962, 1963 and 1966, an average of the remaining 6 years volumes indicates 191,300 CY annually. It is recognized that no individual year will probably ever meet this volume, but that over a 10-year period variations in demand and activity may well call for this magnitude of spoil removal.

The validity of this projection may be enhanced during the next 10 years by demands upon higher rates of coal consumption in the current energy crisis. It seems plausible that port cities, which only a few years ago switched from coal to natural gas and fuel oil for electric power generation and general heating, may have to revert to coal. Harbor facilities, which were downgraded and allowed to shoal to recreational boating depths and fishing boat drafts, etc. may have to be reopened to project depths for the larger coal freighters. Docking facilities, including "alongside" draft depth, are usually the responsibility of the dock owner and/or the other private interests who use it. Examples of downgraded harbors in Lake Superior include Ashland, Bayfield, Big Bay, Black River, Cornucopia, Eagle Harbor, Grand Traverse, Knife River, Lac La Belle, and Saxon. Most of these harbors are now open to boats of 1 to 6 foot drafts.

## Canadian Maintenance Dredging History

Canadian harbors represent a relatively small percent of the dredging activity in Lake Superior. Within the 13-year period of record examined, 5 of the 9 Canadian harbors have been serviced by maintenance dredging. These are, Kam River, Mission Channel, Montreal River, Nipigon, and Port Arthur (Thunder Bay). It should be noted that, "In 1970, the cities of Fort William and Port Arthur were amalgamated into one new city called the city of Thunder Bay. The harbor of the city of Thunder Bay is officially known as the Lakehead Harbour, and is administered by the

Lakehead Harbour Commission" (10). Dredging areas in the Thunder Bay area are historically listed under Kam River, Mission Channel, Port Arthur, Fort William and Lakehead. In this study, activity is consolidated under the heading of Thunder Bay. During the record period, Kam River has been dredged almost annually, Mission Channel has been maintained 8 out of the 13 years, Montreal River's last 2 years of maintenance occurred in 1960 and 1961. Nipigon (Red Rock) has been dredged for maintenance purposes 4 out of the last 13 years and Thunder Bay has been worked 9 years.

During the sample decade, maintenance dredging has been performed from one to 4 projects per year. The years 1961, 1965 and 1966 were peak activity years, showing 4 projects annually. Thunder Bay was the only harbor serviced in 1969.

Five Canadian harbors are maintained with some regularity. Historic records indicate that 3,827,872 CY have been removed during maintenance work, representing 98 percent of all historic Canadian dredging. Virtually all of the significant volume of maintenance dredging has taken place in the Thunder Bay area. Nipigon Harbor is dredged occasionally to relieve minor shoaling problems.

On a 10-year average basis, only 86,000 CY are moved per year.

Canadian New Work--

Most Canadian harbors were first opened during the logging days and have required very little new work or capital dredging since the initial development. New work was performed in 2 of the 9 harbors during the record period. These were Michipicoten and Mission Channel which were dredged in 1971 and 1962-1963 respectively.

Canadian historic records indicate new work volumetric data for Michipicoten and Mission Channel. Their total of 59,551 CY represents 1.5 percent of historic dredging in the Canadian ports. This figure is

Table 48. DREDGING QUANTITIES IN LAKE SUPERIOR PROJECTS[a]
(1000's cubic yards)

| Project of more than 30,000 CY/yr. | Annual total volume |
|---|---|
| Ashland, Wisconsin | 60 |
| Duluth-Superior, Minnesota-Wisconsin | 796 |
| Keweenaw Waterway, Michigan | 30 |
| Little Lake, Michigan | 32 |
| Marquette, Michigan | 34 |
| Ontonagon, Michigan | 46 |
| Kam River, Ontario | 129 |
| Mission Channel, Ontario | 70 |
| Port Arthur, Ontario | 116 |

[a]Includes maintenance, private, and new work.

Table 49. CANADIAN DREDGING IN LAKE SUPERIOR: HISTORIC TOTALS BY HARBOR, TEN-YEAR TOTALS, AND AVERAGE VOLUME PREDICTIONS (48, 54)
(annual cubic yardage)

| Harbor | Historic 1951-1970 per D.P.W. | Totals this study | Total from 1961-1970 | Annual projection | Pollution % | Pollution Class | Vol./Yr. | Disposal area |
|---|---|---|---|---|---|---|---|---|
| Kam River[a] | 6,290,900 | 1,640,541 | 1,294,747 | 220,000[b]<br>129,747[c] | 100 | P | 129,747 | LF |
| Maimainse | 4,040 | -- | -- | -- | 0 | U | -- | -- |
| Michipicoten | -- | 6,500 | -- | 1,400[b] | 0 | U | -- | R |
| Mission Channel | (see Kam R.) | 1,016,278 | 697,540 | 69,754[c] | -- | U | -- | OL |
| Montreal R. | -- | 3,000 | 1,500 | 130[c] | -- | U | 0 | OL |
| Nipigon (Red Rock) | 34,360 | 34,353 | 12,783 | 1,000[b]<br>1,278[c] | 100 | P | 1,278 | LF |
| Peninsula | -- | 0 | 0 | 0 | 0 | U | 0 | -- |
| Port Arthur | 3,660,680 | 1,188,068 | 1,163,538 | 80,000[b]<br>116,353[c] | 0 | U | 0 | OL<br>LF |
| Port Arthur-Keefer Term. | 357,000 | -- | -- | d | -- | P | -- | LFD |
| Sault Ste. Marie | 108,200 | 0 | 0 | 6,800[c] | 0 | U | -- | OL |
| Nipigon R. | 56,560 | -- | -- | -- | -- | U | -- | OC |

Table 49. (continued)

| | | |
|---|---|---|
| Annual volume projections: | 302,400[b]<br>323,789[c] | Polluted: 130,752 |
| If Leigh Harbor capital project is completed, the total D.P.W. projection is: | 587,400 | |

[a]Includes Mission Channel.

[b]Department of Public Works (D.P.W.).

[c]In this study.

[d]Future work to be included with Port Arthur data.

[e]See Leigh Harbor

R river; OL open lake; LF landfill; OC overcast; LFD diked.

undoubtedly not representative of Canadian activity in harbor development and therefore cannot be used for projections.

Canadian Private Dredging--

Although there is considerably less government surveillance of private dredging in Canada than in the United States, Canadian records reveal that only Mission Channel has been dredged by private interests. Private operators have performed work in 1965-1967 and in 1970, removing 1295 CY. Three harbors, i.e., Mamainse, Peninsula and Sault Ste. Marie show no record of dredging for navigational purposes. However, an estimate of 1000 CY per year would cover usual minimal activity.

Private interests have dredged commercial sand and gravel at the rate of about 42,000 CY per year from the St. Marys River entrance channel. Approximately 100,000 CY of sand and gravel have been dredged in the last 10 years from the Algoma Steel approach channels. In any event, the impact of private operations in Canada cannot be considered significant to dredge volume totals or disposal problems. With the figures available it appears that private work is less than 0.5 percent of the Canadian volume.

Summary

Tables 47 and 49 present details of U.S. and Canadian dredging activity in Lake Superior. However, the principal dredging activity is summarized in Table 48 below.

SUMMARY OF FUTURE DREDGING VOLUMES IN THE
IN THE GREAT LAKES

An average of 15.56 million CY of sediment will be dredged annually from the harbors and connecting channels of the Great Lakes during the next decade. Approximately 78 percent of this total will be removed from the American harbors and waterways. Of the future annual volume to be removed from United States' dredging projects, 64 percent involves maintenance dredging, 19 percent consists of new work, and 17 percent involves private dredging. In Canada, these percentages are 31, 54, and 15, respectively. Estimates of future dredging volumes are summarized by lake as follows:

1. With regard to maintenance dredging, an annual average of 8.85 million CY of spoil will be dredged from public harbors and connecting channels by the C.E. and the D.P.W. combined (Table 50). About 88 percent of this volume will be dredged from American projects and 12 percent from Canadian projects. As in the past, Lake Erie will be the center of the maintenance dredging activity. About 56 percent of the total volume will be removed from projects on this lake, including the Detroit River. Compared to the past decade, future maintenance dredging in the Great Lakes is expected to exhibit little change.

2. It is projected that private interests will dredge an average of 2.59 million CY annually during the next decade. Approximately 80 percent of this quantity will be removed in dredging American projects, while 20 percent will involve Canadian projects. Nearly 40 percent is anticipated from Lake Erie, while 27 percent will be derived from Lake Michigan. The number of private dredging permits is expected to increase in the future, and the quantity dredged from Canadian harbors may increase to about 0.5 million CY.

3. An annual average of 4.1 million CY of new work dredging is anticipated during the next 10 years. If all scheduled new work projects are completed, then much of this new work will be accomplished in Lake

Table 50. FUTURE AVERAGE ANNUAL DREDGING VOLUMES IN THE GREAT LAKES
(cubic yards)

| | United States | Canada | Total |
|---|---|---|---|
| Huron/St. Clair | | | |
| Maintenance | 925,000 | 318,000 | 1,243,000 |
| Private | 235,000 | 2,000 | 237,000 |
| New work | 539,500 | 242,000 | 781,500 |
| Michigan | | | |
| Maintenance | 1,491,400 | -- | 1,491,400 |
| Private | 734,700 | -- | 734,700 |
| New work | 737,100 | -- | 737,100 |
| Erie | | | |
| Maintenance | 4,800,000 | 175,000 | 4,975,000 |
| Private | 900,000 | 100,000 | 1,000,000 |
| New work | 550,000 | 0 | 550,000 |
| Ontario | | | |
| Maintenance | 360,000 | 500,000 | 860,000 |
| Private | 30,000 | 400,000 | 430,000 |
| New work | 7,625 | 1,620,000 | 1,627,625 |
| Superior | | | |
| Maintenance | 200,000 | 86,000 | 286,000 |
| Private | 191,000 | 1,000 | 192,000 |
| New work | 418,000 | 0 | 418,000 |
| Totals | | | |
| Maintenance | 7,776,400 | 1,079,000 | 8,855,400 |
| Private | 2,090,700 | 503,000 | 2,593,700 |
| New work | 2,252,225 | 1,862,000 | 4,114,225 |
| | 12,119,325 | 3,444,000 | 15,563,325 |

Ontario. New work scheduled for Toronto Harbor comprises 40 percent of all scheduled new work dredging. As compared to the 1961-1970 period, when an annual average of 9.79 million CY of dredging was performed, future new work dredging will decline sharply. Moreover, most of the projects scheduled involve the construction of new recreational harbors, or the deepening and/or expansion of existing commercial harbors.

4. The 5 harbors and connecting channels with the largest maintenance dredging requirements, in descending order, are: Toledo, Cleveland, Detroit River, Buffalo, and Saginaw. These commercial waterways are characterized by industrial-urban complexes and have 27-foot Seaway channels.

5. If water levels in the Great Lakes drop considerably during the next few years, annual maintenance dredging volumes may somewhat exceed our projections. Conversely, if disposal sites are not available for those public projects which are classified as polluted, maintenance dredging may have to be temporarily postponed until acceptable methods of disposal are found.

## SECTION IV

## POLLUTION OF SPOIL DREDGED FROM THE GREAT LAKES

### INTRODUCTION

In recent years national and provincial policies have been enacted which determine the quality of spoil which can be disposed in the open waters of the Great Lakes. In many dredging projects, particularly in heavily industrialized harbors, these policies may determine the scheduling of future maintenance dredging and the disposal method of the dredged spoil. These policies, which include pollution criteria, apply to federal dredging agencies as well as to private contractors.

In the United States, the eligibility of dredged spoil for open-lake disposal in the waters of the Great Lakes is basically determined by the Criteria for Determining Acceptability of Dredged Spoil Disposal to the Nation's Waters (11). These criteria were developed by the E.P.A. Region V, Chicago, for the Great Lakes and have since been applied nationally. Since 1967, nearly all the federal harbors and waterways maintained by the C.E. have been sampled by the E.P.A. Although private harbors and private channels are not routinely sampled, the pollution criteria are applicable. Surface grab samples of bottom sediments are usually taken throughout the dredging area of each harbor with a Peterson dredge sampler. In Canada, the M.O.E. has developed Water Quality Guidelines for the Review of Proposed Dredging and Spoil Operations (12). The Canadian guidelines are similar to the E.P.A. criteria (Table 51). Sampling by the M.O.E. compares to that of the E.P.A., except that

Table 51. POLLUTION CRITERIA OF HARBOR/WATERWAY SEDIMENTS (54, 55)
(percent)

| Parameter | Canadian guidelines | E.P.A. criteria |
|---|---|---|
| | (Maximum allowable concentration, % dry weight basis) | |
| Volatile solids | 6.0 | 6.0 |
| Chemical oxygen demand | 5.0 | 5.0 |
| Total Kjeldahl nitrogen | 0.2 | 0.1 |
| Oil and grease | 0.15 | 0.15 |
| Mercury | 0.00003 | 0.0001 |
| Zinc | 0.005 | 0.005 |
| Lead | 0.005 | 0.005 |

frequently more samples are taken and occasionally short sediment cores are analyzed.

Both sets of pollution criteria comprise seven mandatory parameters. In Canada, sediments having concentrations of pollutants lower than the acceptable limits may still be deemed unsuitable for open-lake disposal on the basis of one or more of the following tests:

Total phosphorus
Settleability measured in Jackson Turbidity Units
Sulfides
Trace metals including cadmium, copper, chromium, arsenic and nickel
Pesticides
Bioassay for toxicity

In the United States the following additional tests are recommended where appropriate and pertinent:

Total phosphorus

Total organic carbon

Immediate oxygen demand

Settleability

Sulfides

Trace metals including cadmium, copper, chromium, arsenic and nickel

Although sediment quality is a primary determinant of the eligibility of dredged spoil for open-lake disposal, other factors may influence the selection of a disposal method in Canada and the United States including:

Volume of dredged material

Existing and potential quality and the use of the water in the disposal area

Other lake conditions at the disposal site such as depth and currents

Time of the year disposal

Method of disposal

Physical, chemical, and biological characteristics of the dredged spoil

Duration of disposal operations

In Section III, projections of future annual maintenance dredging volumes were presented. In this section, where data are available, the public harbors in the United States are classified as unpolluted, partially polluted, and polluted. The classification was based on the distribution of polluted bottom samples, as analyzed by the E.P.A., taken from each of the dredging projects. A dredging project is considered polluted if the analyses reveal that at least one pollution parameter exceeds the acceptable limits in all of the samples taken. In some harbors, only a portion of the total dredging area was deemed polluted by the bottom sediment analyses. Such harbors are considered partially polluted. In Canada, projects have not been formally classified in this manner. However, for the purpose of arriving at an overview of the polluted and unpolluted volumes of maintenance dredgings, harbors which exceed the M.O.E. pollution criteria are considered polluted, while those that do not exceed the criteria are classified as unpolluted.

Sampling by the E.P.A. and the M.O.E. is continually occurring, usually prior to maintenance dredging. Several high volume and economically significant projects such as Sandusky, Toledo, Duluth, Milwaukee, and Lake St. Clair have been sampled since the completion of this report. As the analyses were not available before February, 1973, the data presented in this section are through mid-1973.

## QUANTITY OF POLLUTED DREDGED SPOIL IN LAKE ONTARIO

Projects in Lake Ontario exhibit a high correlation between industrial/commercial port activities and sediment pollution. Of the 5 U.S. harbors which were sampled by the E.P.A., only Rochester and Oswego are classed as entirely polluted. These are the major ports of commercial activity on the lake. One other American harbor, Great Sodus, is classed as partially polluted. Wilson and Little Sodus, both small and with no commercial traffic, are classed as unpolluted. Of the 6 Canadian harbors on Lake Ontario which were sampled by the M.O.E., all exceed the maximum allowable concentration of some pollutant in at least a few samples (Figure 11). For the purposes of this report, these harbors are classed as polluted. Thus, of 11 sampled harbors in Lake Ontario, American and Canadian combined, 9 are at least partially polluted.

A total of 27 sediment samples have been taken from American dredging projects in Lake Ontario. The average number of samples analyzed per harbor is 5 (Table 52). The range in number of samples is from 4 at harbors such as Wilson and Little Sodus to 5 at Rochester and Great Sodus and 9 at Oswego. All samples were taken from 1968 to 1971. The most commonly occurring pollutants in American dredging projects are phosphorus, oil and grease, Kjeldahl nitrogen, and volatile solids. All of these, particularly phosphorus, were excessive in most samples tested.

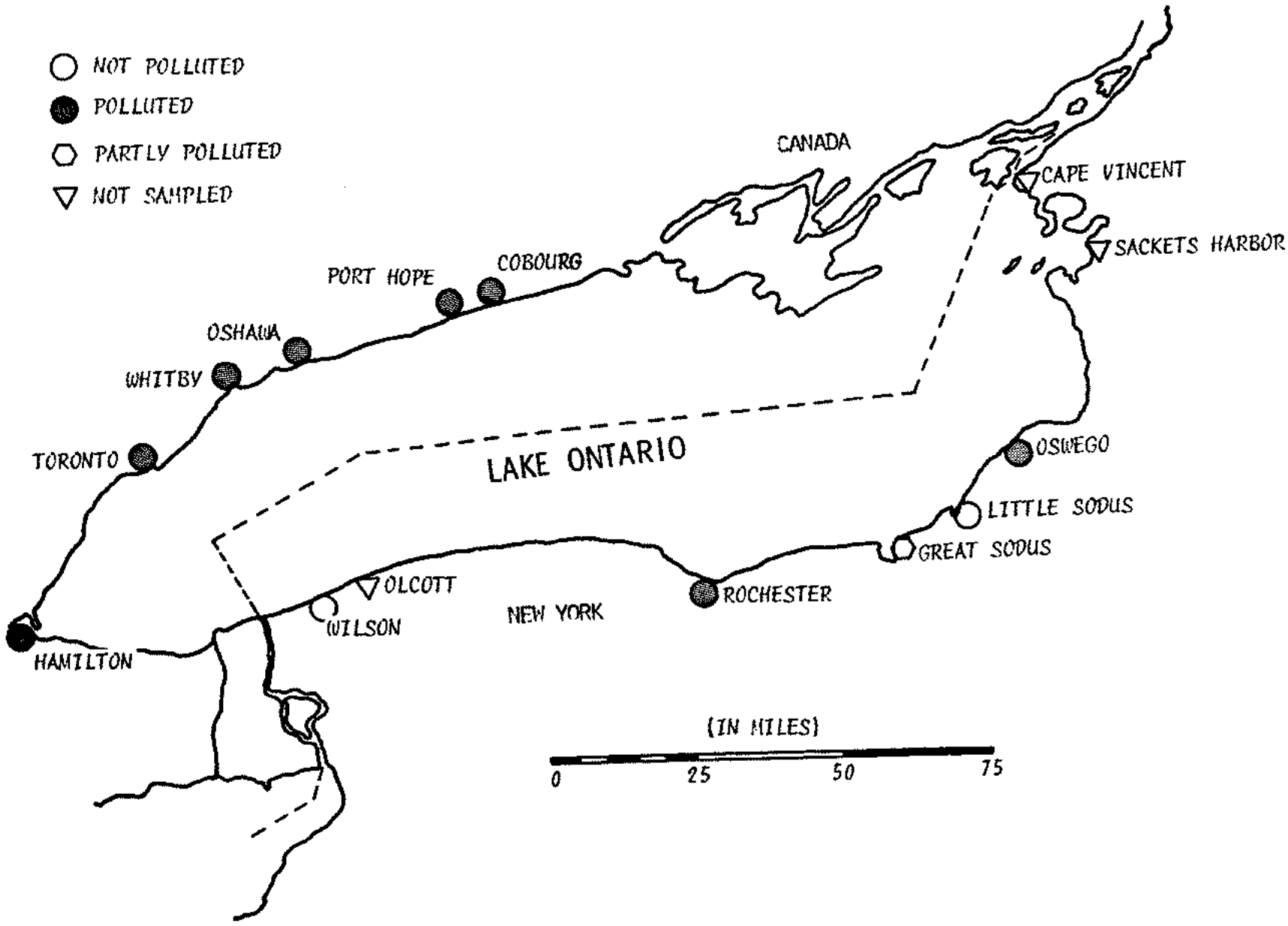



Figure 11. POLLUTION STATUS OF HARBORS IN LAKE ONTARIO

Table 52. SAMPLING OF PROJECTS ON LAKE ONTARIO (54, 55)

| Harbor | Year sampled | No. of samples | Number exceeded | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | P | sol. | COD | Kjel. N | Oil & grease | Fe | Hg | Pb | Zn |
| U.S. samples | | | | | | | | | | | |
| Great Sodus | 1968 | 5 | 5 | 3 | 0 | nt | nt | nt | nt | nt | nt |
| Little Sodus | 1969 | 4 | 4 | 1 | 2 | 2 | 1 | nt | nt | nt | nt |
| Oswego | 1969 | 9 | 9 | 4 | 4 | 5 | 6 | nt | nt | nt | nt |
| Rochester | 1969 | 5 | 5 | 0 | 0 | 1 | 5 | 0 | nt | nt | nt |
| Wilson | 1970 | 4 | 2 | 2 | 3 | 3 | 0 | 0 | nt | nt | nt |
| Olcott | No data | | | | | | | | | | |
| Totals | | 27 | 25 | 10 | 9 | 11 | 12 | 0 | - | - | - |
| Canadian samples | | | | | | | | | | | |
| Cobourg | '71,'72 | 8 | 7 | 1 | 3 | 6 | 3 | nt | nt | nt | 5 |
| Hamilton | '70,'72 | 24 | 19 | 14 | 24 | 21 | 17 | nt | 4 | 9 | 11 |
| Oshawa | '70,'72 | 34 | 17 | 5 | 6 | 15 | 16 | nt | nt | 1 | 19 |
| Port Hope | 1972 | 4 | 4 | 0 | 4 | 4 | 1 | nt | nt | 1 | 1 |
| Toronto | '72,'73 | 181 | 90 | 2 | 65 | 90 | 20 | nt | 2 | 49 | 50 |
| Whitby | 1971 | 11 | nt | 10 | 11 | nt | nt | nt | nt | nt | 11 |
| Totals | | 262 | 137 | 32 | 113 | 136 | 57 | -- | 6 | 60 | 97 |

nt Not tested.

A total of 262 samples have been analyzed for Canadian harbors on Lake Ontario. Canadian samples average about 44 per harbor; but this average is skewed by 181 samples taken from Toronto Harbor. The range is from 4 at Port Hope and 8 at Cobourg to 34 at Oshawa and 181 at Toronto. All samples were taken during the years 1970 to 1973. Phosphorus, Kjeldahl nitrogen, zinc, and chemical oxygen demand are the most commonly surpassed pollution parameters in Canadian waters of Lake Ontario. Apparently, zinc tests are considered more important by the M.O.E. than by the E.P.A. Of the 6 Canadian harbors samples, all were tested for zinc. Zinc tests were not made at any of the 5 American harbors sampled.

## Future Quantity of Polluted Spoil

### U.S. Projects--

Since most spoil dredged by permit is presently being confined and since most new work dredging involves unpolluted material, the projections of future polluted spoil in this report involve only maintenance dredging over the next decade. From 1961 to 1970, an average of approximately 363,000 cubic yards of spoil were removed from U.S. projects annually in maintenance dredging. Of this volume, about 334,000 cubic yards (92 percent) involved polluted spoil (Table 53). The volume of polluted spoil was calculated on the basis of the E.P.A. classification of harbors and detailed analysis of their sediment sample maps.

Maintenance dredging in the next decade should result in the removal of approximately the same total volume of spoil that was removed during the 1960's. Most of the material to be dredged in the future will be polluted spoil from Rochester and Oswego, the major commercial harbors in Lake Ontario (Figure 12). Thus, it is projected that unless unlimited open-lake disposal is permitted to resume as a result of severe economic stress or relaxation of pollution standards, confinement of more than 90 percent of the material to be dredged in the next decade will be necessary. This means that 3.3 million cubic yards of dredged spoil will

Table 53. VOLUME OF POLLUTED DREDGED SPOIL, C.E. PROJECTS IN LAKE ONTARIO, 1961-1970
(cubic yards)

| Project | Year E.P.A. sampled | Pollution class | Average annual maintenance dredging | Percent polluted | Volume of polluted spoil |
|---|---|---|---|---|---|
| Great Sodus | 68 | P/U | 23,763 | 50 | 11,882 |
| Little Sodus | 69 | U | 15,075 | 0 | 0 |
| Oswego | 69 | P | 54,683 | 100 | 54,683 |
| Rochester | 69 | P | 267,029 | 100 | 267,029 |
| Wilson | 70 | U | 948 | 0 | 0 |
| Olcott | no data | - | 2,116 | -- | -- |
| Totals | | | 363,614 | | 333,594 |

have to be confined in diked sites in the Lake Ontario region during the next 10 years.

As of July, 1974, the only Lake Ontario projects in the C.E.'s confined disposal program were at Rochester and Oswego. At Rochester, a site has been selected, and construction is planned for 1976. Oswego had no site agreement as of July, 1974, but construction is scheduled for 1975. Thus, for most dredging in the lake, confined disposal facilities are expected to be available by 1977. Volumes of material removed in the past few years have been slightly lower than the average removed during the 1960's; they should increase in the latter 1970's and remain higher than average into the early 1980's.

Canadian Projects--

From 1961 to 1970 an average of approximately 536,000 cubic yards of spoil were removed from Canadian waters of Lake Ontario every year in

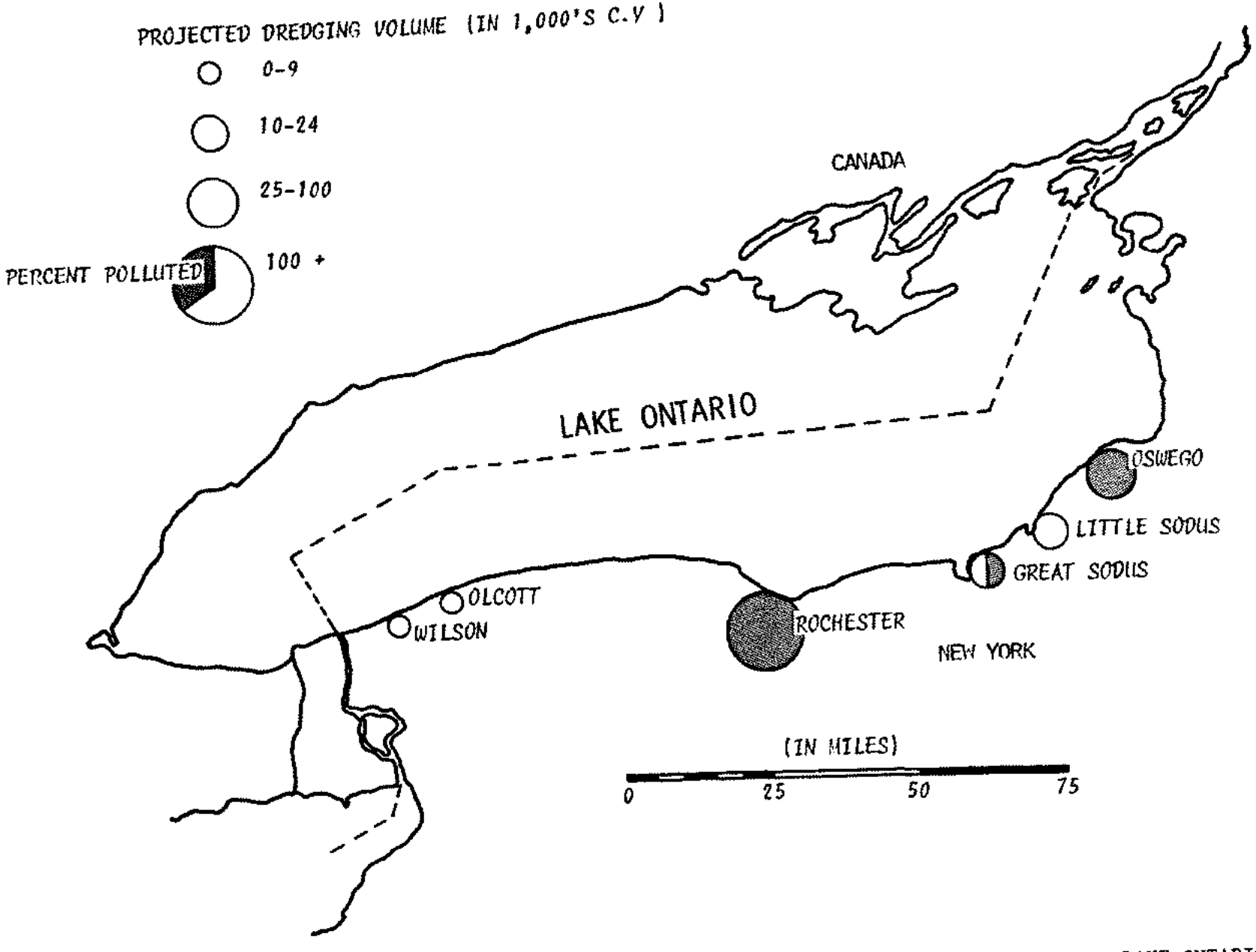



Figure 12. PROJECTED ANNUAL POLLUTED AND UNPOLLUTED MAINTENANCE DREDGING VOLUMES IN LAKE ONTARIO

maintenance dredging projects. However, maintenance dredging volumes are anticipated to decline slightly in the next decade. Projections made available by the D.P.W. indicate that only approximately 435,000 cubic yards of spoil are expected to be dredged in maintaining harbors on Lake Ontario by 1977. About 97 percent of this volume is to be removed from Toronto, Whitby, Oshawa, and Cobourg Harbors, all of which have been sampled by the M.O.E. (Table 52). All harbors had some samples which exceeded at least some pollution parameters and, for the purposes of this report, are considered polluted. Assuming that the Canadian projects which have not been sampled are not polluted, then approximately 420,000 cubic yards of polluted spoil will be dredged by 1977 from Canadian harbors. This represents about 97 percent of the total volume of material scheduled for dredging in Canadian waters of the lake in the near future.

Four of the 5 harbors scheduled for maintenance dredging in the near future have been sampled to date. Four other harbors (Hamilton, Port Hope, Port Credit, and Cataraqui) are dredged at least occasionally. Thus, the percentage of polluted spoil to be removed in the future is, at best, a rough estimate. More accuracy in estimating future polluted volumes in Canada will only be possible when all projects are sampled and more test results become available.

Summary

1. Of a total of 11 sampled American and Canadian harbors in Lake Ontario, 9 are polluted or partially polluted.

2. Most commonly occurring pollutants in U.S. projects are phosphorus, oil and grease, Kjeldahl nitrogen, and volatile solids. Phosphorus, Kjeldahl nitrogen, zinc, and chemical oxygen demand are the most commonly surpassed pollution parameters in Canadian waters.

3. Approximately 92 percent of the spoil dredged from American projects during the 1960's was polluted.

4. Approximately 3.3 million cubic yards of polluted spoil dredged from U.S. projects in Lake Ontario are anticipated during the next decade.

5. Major maintenance dredging projects, i.e., Rochester, Toronto, Hamilton, Oswego and Oshawa, have high volumes of polluted spoil.

6. Two Lake Ontario projects, Rochester and Oswego, are in the C.E. diked disposal program; confined facilities are expected to be available at both by 1977.

7. Approximately 435,000 cubic yards of material are scheduled to be removed from Canadian projects on Lake Ontario by 1977. An estimated 97 percent of this material will be polluted.

8. Because many Canadian harbors have not been sampled, future polluted spoil volumes cannot be accurately determined.

## QUANTITY OF POLLUTED DREDGED SPOIL IN LAKE ERIE

According to present operational guidelines drafted by the United States Environmental Protection Agency and the Ontario Ministry of Environment, sediment dredged from Lake Erie is highly polluted. Every harbor or waterway sampled by either agency is at least partially polluted, i.e., some samples in a harbor exceed established pollution criteria. In some cases, such as Bolles, Huron, Fairport, and Ashtabula, samples from inner portions of harbors are classed as polluted whereas those taken from outer portions (usually outside breakwaters) are not. Of 21 U.S. harbors sampled, 15 are classified as entirely polluted and 6 as partially polluted. In Canada, of the 5 harbors sampled, all exceed the maximum allowable concentration of some pollutant in at least a few samples (Figure 13). Thus, all harbors and waterways sampled in Lake Erie exceed pollution criteria established for both United States and Canadian projects.

As of late 1973, a total of 165 samples have been taken from U.S. projects in Lake Erie. The average number of samples analyzed per

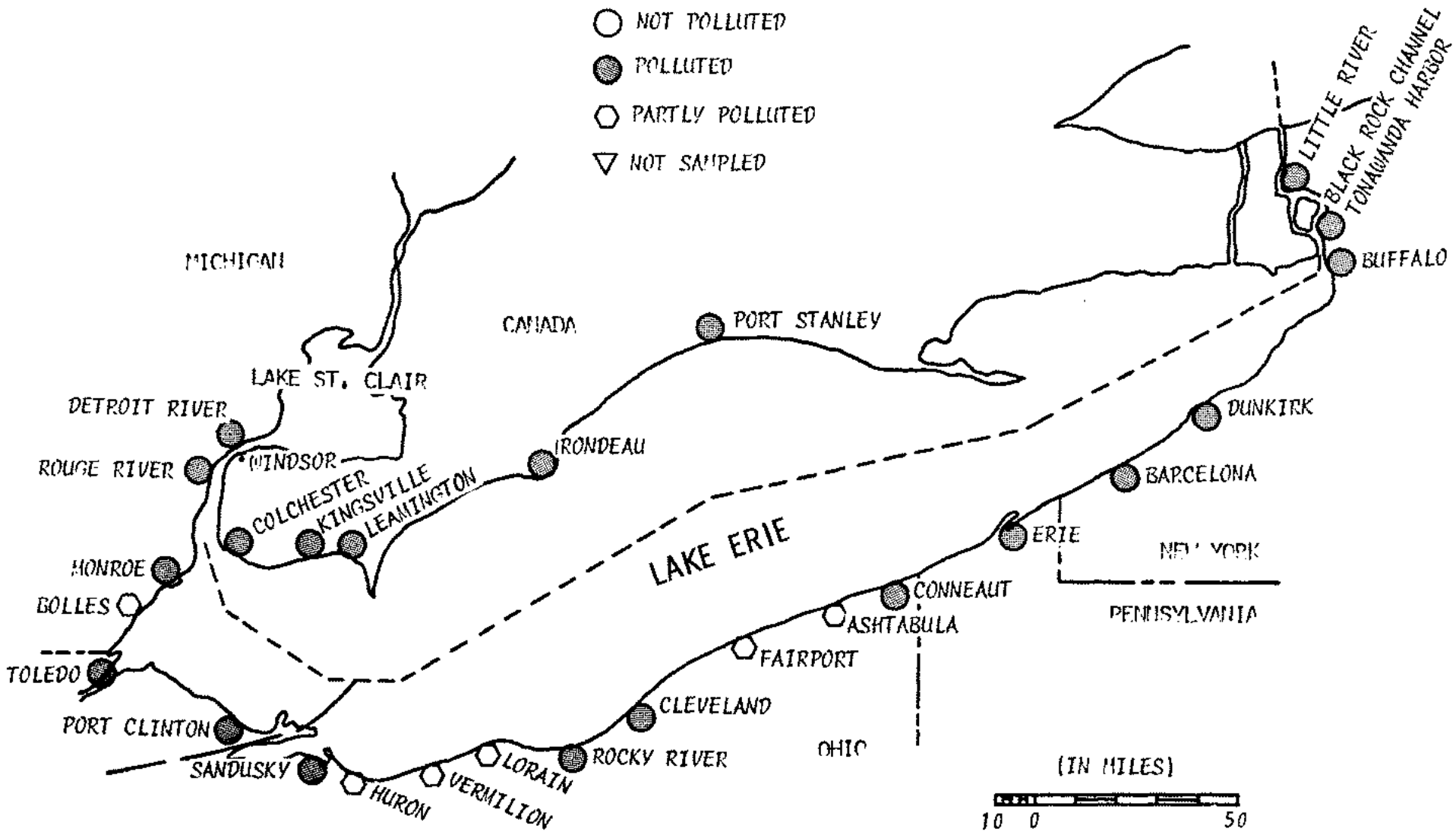



Figure 13. POLLUTION STATUS OF HARBORS IN LAKE ERIE

harbor is 8 (Table 54). The range in number of samples is from 3 at small harbors such as Rocky River, Barcelona, and Dunkirk to 17 at Buffalo and 26 from the Rouge River. All sampling was done prior to 1972. Some sampling has occurred since then, but testing has not been completed. The most commonly occurring pollutants in U.S. projects are phosphorus, oil and grease, Kjeldahl nitrogen, and volatile solids. All of these were excessive in almost every sample tested.

A total of 48 samples have been analyzed for Canadian harbors on Lake Erie. Canadian samples average about 10 per harbor. The range is from 3 at Colchester and Rondeau to 21 at Port Stanley. Phosphorus, Kjeldahl nitrogen, zinc, and COD are the most commonly surpassed pollution parameters in the Canadian projects. Apparently, testing for zinc has been considered more important by the M.O.E. than by the E.P.A. Of the 5 Canadian harbors sampled, 3 were tested for zinc. Of the 21 American harbors and waterways sampled, zinc tests were made at Cleveland and Fairport. In both projects zinc surpassed the E.P.A. criteria.

## Future Quantity of Polluted Spoil

### United States Projects--

Basically polluted dredged spoil is a problem associated with maintenance work. Most spoil dredged by permit is presently being confined and most new work dredging involves unpolluted material. Therefore, the projection of future polluted spoil in this report involves maintenance dredging over the next decade. From 1961 to 1970, an average of approximately 4.6 million cubic yards of spoil were removed from the American waters of Lake Erie every year in maintenance dredging projects. Of this volume, approximately 4.4 million cubic yards, about 95 percent of the total involved polluted material (Table 55). The volume of polluted spoil was calculated on the basis of the E.P.A. latest pollution classification of harbors and detailed analysis of their sediment sample maps.

Table 54. SAMPLING OF PROJECTS ON LAKE ERIE (54, 55)
(number of samples exceeded)

| Harbor | Date of samples | No. of samples | Number exceeded | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | P | Vol. sol. | COD | Kjel. N | Oil & grease | Fe | Hg | Pb | Zn |
| U.S. samples | | | | | | | | | | | |
| Detroit R. | 70 | 15 | 12 | 10 | 5 | 10 | 10 | 7 | 15 | nt | nt |
| Rouge River | 67 | 26 | 23 | 25 | nt | 21 | 24 | 10 | nt | nt | nt |
| Monroe | 69 | 3 | 2 | 3 | 3 | 2 | 2 | 1 | nt | nt | nt |
| Bolles | 72 | 5 | 3 | 1 | 1 | 1 | 1 | nt | nt | nt | nt |
| Toledo | 68 | 11 | 11 | 11 | 11 | 11 | 9 | 11 | nt | nt | nt |
| Port Clinton | 68 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | nt | nt | nt |
| Sandusky | 68 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | nt | nt | nt |
| Huron | 68 | 5 | 4 | 5 | 5 | 5 | 5 | 5 | nt | nt | nt |
| Vermilion | 68 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | nt | nt | nt |
| Lorain | 68 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | nt | nt | nt |
| Rocky River | 70 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | nt | nt | nt |
| Cleveland | 72 | 15 | 15 | 15 | 15 | 15 | 15 | nt | 15 | 15 | 15 |
| Fairport | 72 | 6 | 6 | 6 | 6 | 5 | 5 | nt | 0 | 6 | 6 |
| Ashtabula | 68 | 7 | 7 | 1 | 0 | 6 | 3 | 5 | nt | nt | nt |
| Conneaut | 68 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | nt | nt | nt |
| Erie | 68 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | nt | nt | nt |
| Barcelona | 70 | 3 | 2 | 1 | 1 | 2 | 3 | 2 | nt | nt | nt |
| Dunkirk | 68 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | nt | nt | nt |
| Buffalo H&R | 67 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | nt | nt | nt |
| Black Rk. Ch. | 67 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | nt | nt | nt |
| Little River | No data, but classed polluted by E.P.A. | | | | | | | | | | |
| Tonawanda Hbr. | No data, but classed polluted by E.P.A. | | | | | | | | | | |
| Totals | | 165 | 154 | 147 | 116 | 147 | 146 | 110 | 30 | 21 | 21 |
| Canadian samples | | | | | | | | | | | |
| Port Stanley | 70,71 | 21 | 21 | 0 | 13 | 21 | nt | nt | 0 | nt | 19 |
| Rondeau | 71 | 3 | 3 | 2 | nt | 3 | nt | nt | nt | nt | nt |
| Leamington | 70 | 6 | 6 | 0 | 6 | 6 | nt | nt | 0 | nt | 4 |
| Kingsville | 70,72 | 15 | 15 | 0 | 12 | 11 | 1 | nt | 10 | nt | 12 |
| Colchester | 71 | 3 | nt | 2 | 3 | 3 | nt | nt | nt | nt | nt |
| Totals | | 48 | 45 | 4 | 34 | 44 | 1 | nt | 10 | nt | 35 |

[a] nt Not tested

Table 55. VOLUME OF POLLUTED DREDGED SPOIL: C.E. PROJECTS IN LAKE ERIE, 1961-1970
(cubic yards)

| Project | Year E.P.A. sampled | Pollution class | Ave. annual maintenance dredging | Percent polluted | Volume of polluted spoil |
|---|---|---|---|---|---|
| Detroit District | | | | | |
| Bolles | 1972 | P/U | 8,737 | 75 | 6,553 |
| Detroit River | 1970 | P | 324,507 | 100 | 324,507 |
| Monroe | 1969 | P | 184,629 | 100 | 184,629 |
| Port Clinton | 1968 | P | 5,961 | 100 | 5,961 |
| Rouge River | 1967 | P | 202,121 | 100 | 202,121 |
| Toledo | 1973 | P | 1,083,791 | 100 | 1,083,791 |
| District totals | | | 1,809,746 | | 1,807,562 |
| Buffalo District[a] | | | | | |
| Ashtabula | 1968 | P/U | 125,769 | 75 | 94,327 |
| Black Rk. Ch./ Tonawanda Hbr. | 1967 | P | 83,498 | 100 | 83,498 |
| Buffalo | 1967 | P | 448,824 | 100 | 448,824 |
| Cleveland | 1972 | P | 875,629 | 100 | 875,629 |
| Conneaut | 1968 | P | 68,704 | 100 | 68,704 |
| Dunkirk | 1968 | P | 12,109 | 100 | 12,109 |
| Erie | 1968 | P | 162,033 | 100 | 162,033 |
| Fairport | 1972 | P/U | 302,687 | 80 | 242,150 |
| Huron | 1973 | P/U | 151,935 | 75 | 151,935 |
| Lorain | 1968 | P/U | 120,199 | 80 | 96,159 |
| Rocky River | 1970 | P | 708 | 100 | 708 |
| Sandusky | 1973 | P | 439,704 | 100 | 439,704 |
| District totals | | | 2,791,799 | | 2,637,796 |
| Totals for Lake Erie | | | 4,601,545 | | 4,445,358 |

[a]Vermilion, Barcelona, and Little River are rarely dredged.

As determined in Section III, maintenance dredging in the next decade should result in the removal of approximately the same total volume of spoil that was removed during the 1960's. Most of the material to be dredged in the future will be polluted spoil from the large commercial harbors in Lake Erie (Figure 14). Thus, it is projected that unless unlimited open-lake disposal is permitted to resume as a result of severe economic stress or relaxation of pollution standards, confinement of more than 90 percent of the material to be dredged in the next decade will be necessary. This means that 40 to 45 million cubic yards of dredged spoil will have to be confined during the next 10 years.

As of July, 1974, 19 projects were in the diked disposal program for Lake Erie. They were at various degrees of completion, from planning to actual construction. For most dredging projects in the lake, confined disposal facilities are expected to be available by 1977 (Table 56). Thus, confined disposal should occur by that time. Volumes of material removed in the past few years have been slightly lower than the average removed during the 1960's. However, they should increase in the latter 1970's and remain higher than average into the early 1980's.

Canadian Projects--

From 1961 to 1970, an average of approximately 351,000 cubic yards of spoil were removed from Canadian projects in Lake Erie annually in maintenance dredging projects. But due to the loss of Port Burwell's volumes with a change in status as previously discussed, maintenance dredging in the next decade is expected to decline and average between 150,000 and 200,000 cubic yards annaully.

Projections made available by the D.P.W. indicate that about 542,000 cubic yards of spoil are expected to be dredged from public harbors on Lake Erie by 1977. About 70 percent of this volume is to be removed from Port Stanley, Rondeau, Leamington, Kingsville, and Colchester, harbors which have been sampled by the M.O.E. (Table 54). These

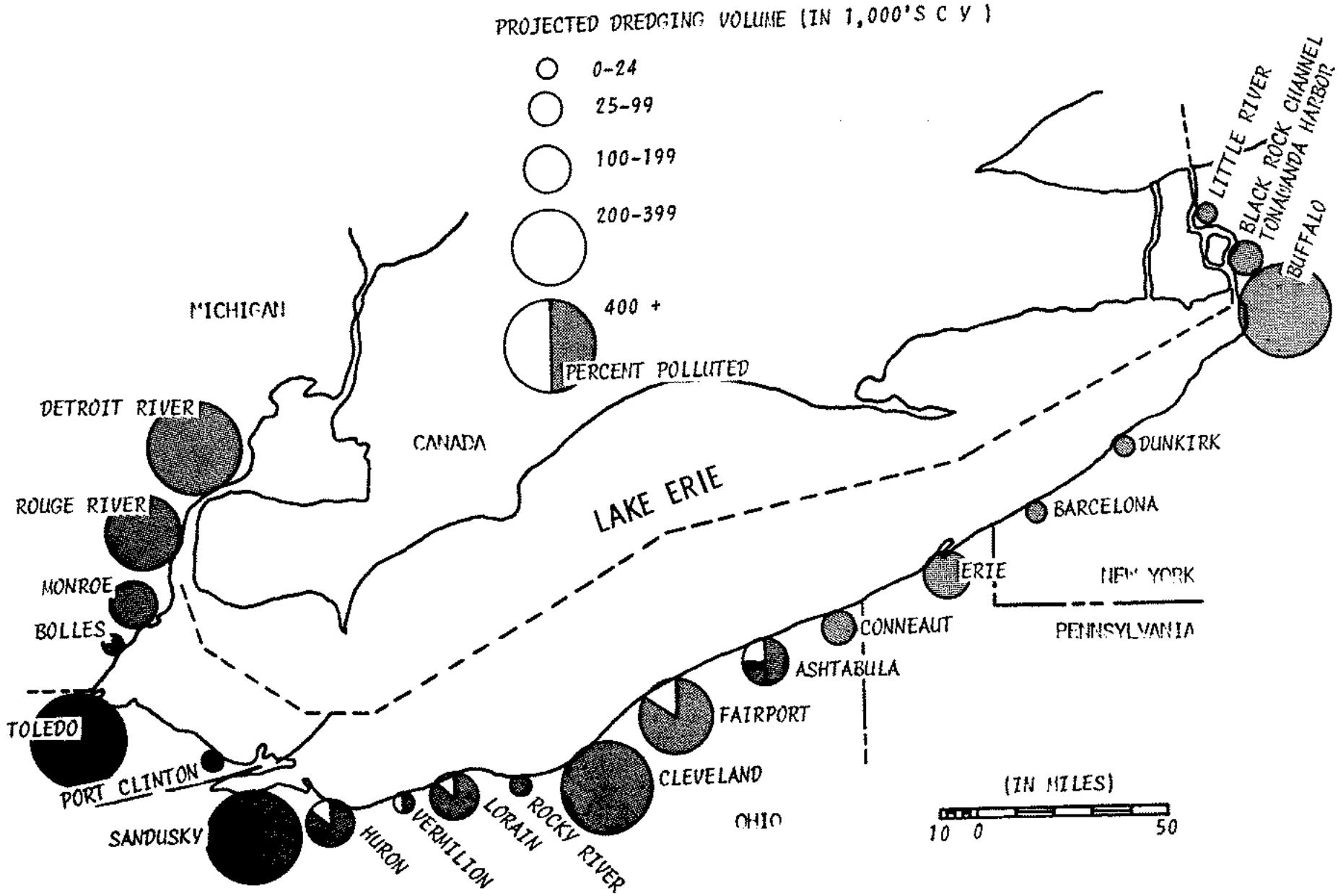



**Figure 14. PROJECTED ANNUAL POLLUTED AND UNPOLLUTED MAINTENANCE DREDGING VOLUMES IN LAKE ERIE**

Table 56. 1974 STATUS OF LAKE ERIE DIKED DISPOSAL PROGRAM (52)

| Project | On program | Site being used now | Site selected | Construction date |
|---|---|---|---|---|
| Rouge River | x | x | x | 1975 |
| Detroit River | x | x | x | 1975 |
| Toledo | x | x | x | 1974 |
| Port Clinton | x | - | - | -- |
| Monroe | x | x | - | -- |
| Bolles | x | - | x | 1974 |
| Ashtabula | x | - | x | 1976 |
| Buffalo | x | x | x | 1974 |
| Black Rock/Tonawanda | x | x | x | 1974 |
| Cleveland | x | x | x | 1974-75 |
| Conneaut | x | - | x | 1974 |
| Erie | x | - | x | 1975 |
| Fairport | x | - | x | 1975 |
| Huron | x | - | x | 1974 |
| Lorain | x | - | x | 1975 |
| Sandusky | x | - | x | 1975 |
| Dunkirk | x | - | - | 1975 |
| Vermilion | x | - | - | 1975 |
| Little River | x | - | - | 1975 |
| Rocky River | x | - | - | 1975 |

harbors yielded some samples which exceeded at least some pollution parameters and, for the purpose of this report, are considered polluted. Assuming that the Canadian projects which have not been sampled are not polluted, then approximately 380,000 cubic yards of polluted spoil will be dredged by 1977. This represents about 70 percent of the total volume of material scheduled for dredging in Canadian waters of the lake in the near future.

Only 5 of the 14 harbors scheduled for maintenance dredging in the future have been sampled to date by the M.O.E. Thus, the percentage of polluted spoil to be removed in the future, as projected above, is only an estimate. More accuracy in estimating future polluted volumes on the Canadian side of Lake Erie will only be possible when all projects are sampled and more test results completed.

Summary

1. Of the 21 sampled American harbors on Lake Erie, 15 are entirely polluted and 6 are partially polluted. All 5 Canadian harbors sampled exceeded the maximum allowable concentration of at least one pollutant.

2. Most commonly occurring pollutants in U.S. harbors are phosphorus, oil and grease, Kjeldahl nitrogen, and volatile solids. Phosphorus, Kjeldahl nitrogen, zinc, and COD are the most commonly surpassed parameters in Canadian projects.

3. Approximately 95 percent of the spoil dredged from American projects in Lake Erie during the 1960's was polluted.

4. Forty to 45 million cubic yards of polluted dredged spoil from American projects are anticipated during the next decade.

5. Major maintenance dredging projects, i.e., Toledo, Cleveland, Sandusky, Buffalo, and the Detroit River, have high volumes of polluted spoil.

6. A few large dredging projects, such as Fairport, Ashtabula, Lorain,

and Huron (with 100,000 to 300,000 cubic yards of material removed annually) are classified as partially polluted.

7. Twenty Lake Erie projects are in the C.E. diked disposal program. Confined facilities for these projects are expected to be available by 1977.

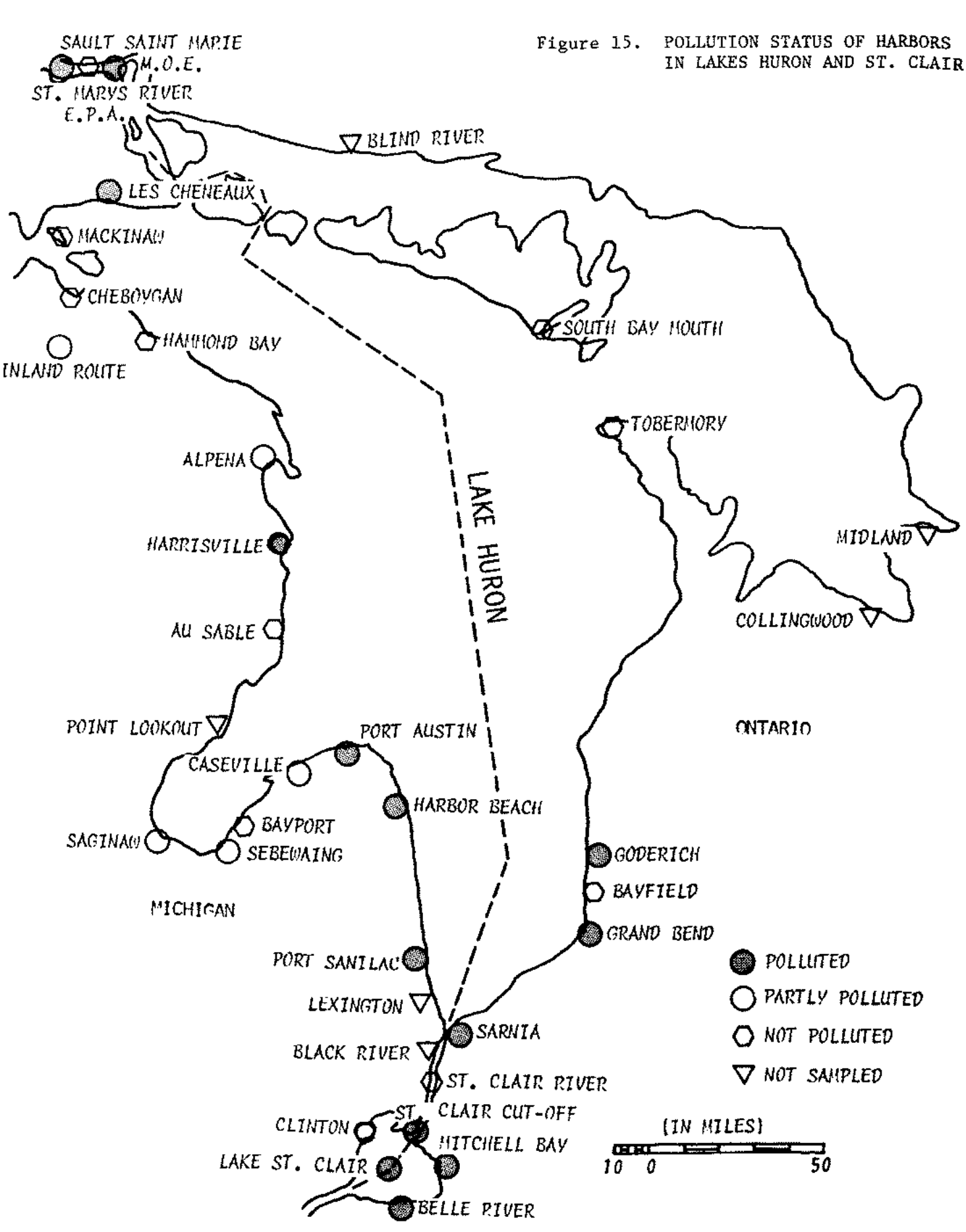
8. About one-half million cubic yards of material are scheduled to be removed from Canadian projects on Lake Erie by 1977. An estimated 70 percent of this material will be polluted.

9. Most Canadian harbors on Lake Erie have not been sampled by the M.O.E. Only when they are sampled are accurate estimates of future polluted spoil volumes possible.

## QUANTITY OF POLLUTED DREDGED SPOIL IN LAKE HURON AND LAKE ST. CLAIR

In Lake Huron and Lake St. Clair a project design cannot always be associated with polluted or unpolluted dredged spoil. Generally, where long approach channels serve river harbors such as Saginaw, the channel sediments are unpolluted whereas the river sediments are polluted. Polluted spoil, however, is not entirely confined to such harbors. Many lakefront harbors, deriving their sediments from the nearshore environment, such as Harrisville and Harbor Beach, have polluted sediments. Figure 15 reveals that in Lake Huron only 10 out of the 30 harbors and waterways sampled do not exceed the principal E.P.A. or the M.O.E. criteria. As mentioned in the introduction of this section, sampling by the M.O.E. is confined to few localities. However, D.P.W. projects have been sampled more thoroughly than C.E. projects. Waterways such as the St. Clair River present significant problems. According to the E.P.A., the St. Clair River sediments are not polluted whereas samples retrieved by the M.O.E. at Sarnia and the St. Clair Cut-off exceed their criteria. Similar problems arise at Sault Ste. Marie. In many instances,

Figure 15. POLLUTION STATUS OF HARBORS IN LAKES HURON AND ST. CLAIR



therefore, it is not possible to classify a harbor or waterway in Lake Huron as completely polluted or unpolluted. There are areas of a dredging project which may be unpolluted whereas other areas are polluted. In Lake Huron, harbors such as Alpena, Caseville, and Sebewaing are therefore categorized as partially polluted (P/U).

In many sediment samples, several parameters have been exceeded and are noted in Table 57. Of the 7 mandatory parameters tabulated for the C.E. projects, COD is the most commonly occurring pollutant followed by volatile solids, and oil and grease. In the D.P.W. projects, Kjeldahl nitrogen and COD are the most common pollution parameters which exceed the M.O.E. criteria. Both environmental agencies confirm the high occurrence of mercury in Lake St. Clair. In Michigan, most C.E. projects have been sampled since 1967 whereas in Ontario only 10 projects have been assessed through 1973. Therefore, based on the number of projects sampled, a more accurate estimate of future polluted dredging volumes may be determined for the C.E. dredging projects.

Projects where sediments were classified as polluted and unpolluted by the E.P.A. were mapped on the Project Maps of the C.E. and the ratio of polluted sediment volume to the unpolluted sediment volume determined. When possible this ratio was confirmed by the C.E. Detroit District. Table 58 represents, by project, future annual maintenance dredging that the C.E. feels necessary to maintain all projects in Lake Huron and Lake St. Clair at project depth and the percent of polluted sediment within each project. Based on these data, 874,650 of the 1.2 million cubic yards or 72 percent of the spoil would not be suitable for open-lake disposal. Table 59 represents a decade (1961-70) of C.E. maintenance dredging in the 2 lakes by project. During the 1960's, 728,776 cubic yards were removed annually from C.E. projects. Assuming that the sediment quality did not change in the past decade, 426,186 cubic yards or 58 percent of these dredgings would have exceeded E.P.A.'s criteria. Therefore, if the C.E. were to meet their projection in the next decade,

Table 57. SAMPLING OF PROJECTS ON LAKE HURON/ST. CLAIR (54, 55)

| Harbor | Year sampled | No. of samples | Number exceeded: Vol. sol. | COD | Kjel. N | Oil & grease | Hg | Pb | Zn |
|---|---|---|---|---|---|---|---|---|---|
| Michigan | | | | | | | | | |
| Alpena | | | | | | | | | |
| Inner | 1972 | 5 | 0 | 2 | 0 | 0 | nt | nt | nt |
| Outer | 1972 | 3 | 1 | 1 | 1 | 1 | nt | nt | nt |
| Au Sable | 1967 | 3 | 0 | nt | 0 | 0 | nt | nt | nt |
| Bay Port | 1972 | 9 | 0 | 0 | 0 | 0 | nt | nt | nt |
| Caseville | 1972 | 4 | 1 | 2 | 2 | 1 | nt | nt | nt |
| Cheboygan | 1967 | 3 | 0 | nt | nt | 0 | nt | nt | nt |
| Clinton R. | 1970 | 4 | 3 | 3 | 3 | 3 | 0 | nt | nt |
| Hammond Bay | 1970 | 2 | 0 | 0 | nt | 0 | 0 | nt | nt |
| Harbor Beach | 1972 | 5 | 4 | 5 | 5 | 0 | nt | nt | nt |
| Harrisville | 1970 | 4 | 0 | 1 | nt | 0 | 0 | nt | nt |
| Inland Route | 1970 | 5 | 3 | 4 | nt | 3 | 0 | nt | nt |
| L. St. Clair | 1970 | 8 | 1 | 3 | 3 | 0 | 6 | nt | nt |
| Les Cheneaux | 1970 | 3 | 3 | 2 | nt | 0 | 0 | nt | nt |
| Lexington | Not sampled | | | | | | | | |
| Mackinaw City | 1970 | 2 | 0 | 0 | nt | 0 | nt | nt | nt |
| Point Lookout | Not sampled | | | | | | | | |
| Port Austin | 1972 | 2 | 0 | 2 | nt | 0 | nt | nt | nt |
| Port Sanilac | 1972 | 7 | 0 | 3 | 5 | 0 | nt | nt | nt |
| Saginaw | | | | | | | | | |
| Inner | 1972 | 10 | 8 | 8 | 2 | 9 | nt | nt | nt |
| Outer | 1972 | 5 | 2 | 4 | 4 | 4 | nt | nt | nt |
| Sebewaing | 1972 | 4 | 3 | 4 | 4 | 3 | nt | nt | nt |
| Straits of Mackinaw | 1970 | 4 | 0 | 0 | nt | 0 | 0 | nt | nt |
| St. Clair R. | 1970 | 7 | 0 | 0 | 0 | 0 | 1 | nt | nt |
| St. Marys R. | 1972 | 15 | 0 | 0 | 0 | 0 | nt | nt | nt |
| Totals | | 114 | 29 | 44 | 29 | 24 | 7 | - | - |
| Ontario | | | | | | | | | |
| Bayfield | 1973 | Visual inspection | | | | | | | |
| Grand Bend | 1973 | 3 | Organics, COD, Zn exceed M.O.E. criteria | | | | | | |
| Goderich | 1973 | 1 | 0 | 0 | 0 | nt | nt | 1 | 0 |
| Mitchell Bay | 1971 | 2 | 0 | nt | 0 | nt | 2 | 0 | 0 |
| Ruscom R. | 1971 | 8 | 3 | nt | 2 | nt | nt | nt | nt |
| St. Clair R. | 1972 | 38 | 0 | 30 | 37 | 0 | 29 | 0 | 2 |
| Sarnia | 1971 | 7 | 1 | 6 | 1 | 7 | nt | nt | nt |
| South Bay M. | 1972 | None exceed M.O.E. criteria | | | | | | | |
| Tobermory | 1972 | 1 | 0 | 0 | 0 | nt | nt | nt | nt |
| Sault Ste. Marie | | | | | | | | | |
| N. of Locks | 1971 | 8 | 2 | 0 | nt | 3 | nt | nt | nt |
| Pt. aux Pins | 1972 | 27 | 4 | 0 | 4 | 4 | nt | 0 | 2 |
| Totals | | 97 | 10 | 36 | 44 | 14 | 31 | 1 | 4 |

[a]nt Not tested

Table 58. C.E. PROJECTED MAINTENANCE DREDGING AND POLLUTED VOLUMES, LAKE HURON/ST. CLAIR (50)
(cubic yards)

| Project | C.E. projection | Percent polluted | Ann. ave. polluted spoil | class | 10-year site completed |
|---|---|---|---|---|---|
| Alpena | 8,000 | 90 | 7,200 | P/U | June, 1976 |
| Au Sable[a] | 30,000 | 0 | 0 | U | -- |
| Bay Port | 6,000 | 0 | 0 | U | June, 1976 |
| Black River[a] | 3,000 | Not sampled | | | -- |
| Caseville | 12,000 | 40 | 4,800 | P/U | October, 1976 |
| Ch. Lake St. Clair | 200,000 | 100 | 200,000 | P | June, 1975 |
| Cheboygan[a] | 10,000 | 0 | 0 | U | -- |
| Clinton River | 21,000 | 85 | 17,850 | P/U | June, 1976 |
| Hammond[a] | 10,000 | 0 | 0 | U | -- |
| Harbor Beach | 5,000 | 100 | 5,000 | P | December, 1976 |
| Harrisville[a] | 12,000 | 100 | 12,000 | P | -- |
| Inland Route | 10,000 | 50 | 5,000 | P/U | December, 1976 |
| Les Cheneaux | 10,000 | 100 | 10,000 | P | December, 1976 |
| Mackinaw City[a] | 4,000 | 0 | 0 | U | -- |
| Port Austin[a] | 4,000 | 100 | 4,000 | P | -- |
| Port Sanilac | 7,200 | 100 | 7,200 | P | June, 1976 |
| Saginaw | 700,000 | 85 | 595,000 | P | June, 1976 |
| Sebewaing | 20,000 | 33 | 6,600 | P/U | October, 1976 |
| St. Clair R.[a] | 75,000 | 0 | 0 | U | -- |
| St. Marys R.[a] | 65,000 | 0 | 0 | P/U | -- |
| Totals | 1,212,200 | | 874,650 (72%) | | |

[a]Not on the 10-year confined disposal program (PL 91-611).

Table 59. VOLUME OF POLLUTED DREDGED SPOIL: C.E. PROJECTS IN LAKE HURON/ST. CLAIR, 1961-1970
(cubic yards)

| Project | Year sampled | Average annual maintenance dredging | Percent polluted | Polluted volume |
|---|---|---|---|---|
| Alpena | 1972 | 9,768 | 90 | 8,791 |
| Au Sable | 1967 | 20,775 | 0 | 0 |
| Bay Port | 1972 | 0 | 0 | 0 |
| Caseville | 1972 | 0 | 30 | 0 |
| Black River | Not sampled | 0 | 0 | 0 |
| Channels of Lake St. Clair | 1970 | 106,828 | 100 | 106,828 |
| Cheboygan | 1967 | 9,123 | 0 | 0 |
| Clinton River | 1970 | 15,350 | 85 | 13,050 |
| Hammond Bay | 1970 | 0 | 0 | 0 |
| Harbor Beach | 1972 | 22,825 | 100 | 22,825 |
| Harrisville | 1970 | 600 | 100 | 600 |
| Inland Route | 1970 | 90 | 50 | 45 |
| Les Cheneaux | 1970 | 10,273 | 100 | 10,273 |
| Lexington | Not sampled | 0 | 0 | 0 |
| Mackinaw | 1970 | 0 | 0 | 0 |
| Point Lookout | Not sampled | 0 | 0 | 0 |
| Port Sanilac | 1972 | 7,670 | 100 | 7,670 |
| Saginaw | 1972 | 294,735 | 85 | 250,524 |
| St. Clair River | 1970 | 91,915 | 0 | 0 |
| St. Marys River | 1972 | 121,912 | 0 | 0 |
| Sebewaing | 1972 | 16,912 | 33 | 5,580 |
| Totals | | 728,776 | | 426,186 (58%) |

Port Austin, sampled in 1972, is 100 percent polluted. However, it has not been dredged in two decades, and no confined disposal site is planned.

a 14 percent increase of polluted dredged spoil over the 1961-1970 decade may be anticipated.

As mentioned in the previous section, the C.E. projection of future maintenance dredging represents a maximum projected figure. Based on dredging frequencies in the recent past, projects such as Port Austin, although classified as polluted, have not been dredged in several years. Thus, the percent of polluted dredged spoil associated with the C.E. dredging projection (Table 58) may indeed be high.

Table 60 illustrates new work and maintenance dredging totals of the C.E. in 1972 and 1973. If it is assumed that dredgings disposed on land are polluted and dredgings disposed in open water are not polluted, it may be concluded that in 1972 about 43 percent of the dredging volume is not suitable for open-lake disposal. In 1973, approximately 53 percent of the spoil did not qualify for open-lake disposal. Based on actual field data over the past 2 years less than one half of the spoils removed from C.E. projects were polluted.

Perhaps the greatest concern of polluted dredged spoil is in projects which have the highest maintenance dredging volumes. Approximately 88

Table 60. DISPOSAL OF SPOIL IN LAKE HURON/ST. CLAIR PROJECTS, 1972 AND 1973 (50)
(cubic yards)

| Project | 1972 | | 1973 | |
|---|---|---|---|---|
| | On land | Open lake | On land | Open lake |
| Au Sable | 0 | 41,625 | 0 | 7,420 |
| Harrisville | 0 | 25,950 | 0 | 0 |
| Inland Route | 76,259 | 0 | 0 | 0 |
| Saginaw | 86,994 | 0 | 87,943 | 21,263 |
| St. Clair R. | 0 | 26,337 | 0 | 8,800 |
| St. Marys R. | 0 | 122,099 | 0 | 40,123 |
| Totals | 163,253(43%) | 216,011(57%) | 87,943(53%) | 77,606(47%) |

percent of the past and future dredging has and will occur in Au Sable, Lake St. Clair, Saginaw, the St. Clair River, and the St. Marys River (Table 33). Assuming that past and future sediment quality is representative of the present sediment quality, 57 percent of the dredgings from these harbors will be polluted (Table 61).

Table 61. ESTIMATED POLLUTED DREDGED SPOIL IN MAJOR C.E. PROJECTS IN LAKE HURON/ST. CLAIR
(cubic yards)

| Project | Annual maintenance dredging--1961-1970 | Percent polluted | Polluted volume |
|---|---|---|---|
| Au Sable | 9,768 | 0 | 0 |
| Saginaw | 294,735 | 85 | 250,524 |
| Lake St. Clair | 106,828 | 100 | 106,828 |
| St. Clair River | 91,915 | 0 | 0 |
| St. Marys River | 121,912 | 0 | 0 |
| Totals | 625,158 | | 357,352 (57%) |

Based on a harbor by harbor projection determined in Section III, the percent of polluted sediment to be dredged may be estimated (Figure 16). As noted in Table 62, the greatest volume of polluted dredged spoil will be derived from Saginaw and Lake St. Clair. Other areas where relatively high volumes of polluted sediments occur are Inland Route, Harbor Beach, Les Cheneaux, Alpena, and Sebewaing. Of the above mentioned projects, Saginaw faces the most serious problem in terms of confined disposal. Dow Chemical Company withdrew their site offer and the Michigan Department of Natural Resources is opposed to filling bottom land near the shoreline (13). The C.E. has estimated that there is a backlog of 2.5 million cubic yards of sediment which is increasing at a rate of approximately 600,000 cubic yards annually. The channel depth has been reduced from between 4 to 7 feet above project depth. To our knowledge an Environmental Impact Statement has not been prepared for this project.

Figure 16. PROJECTED ANNUAL POLLUTED AND UNPOLLUTED MAINTENANCE DREDGING VOLUMES IN LAKES HURON AND ST. CLAIR

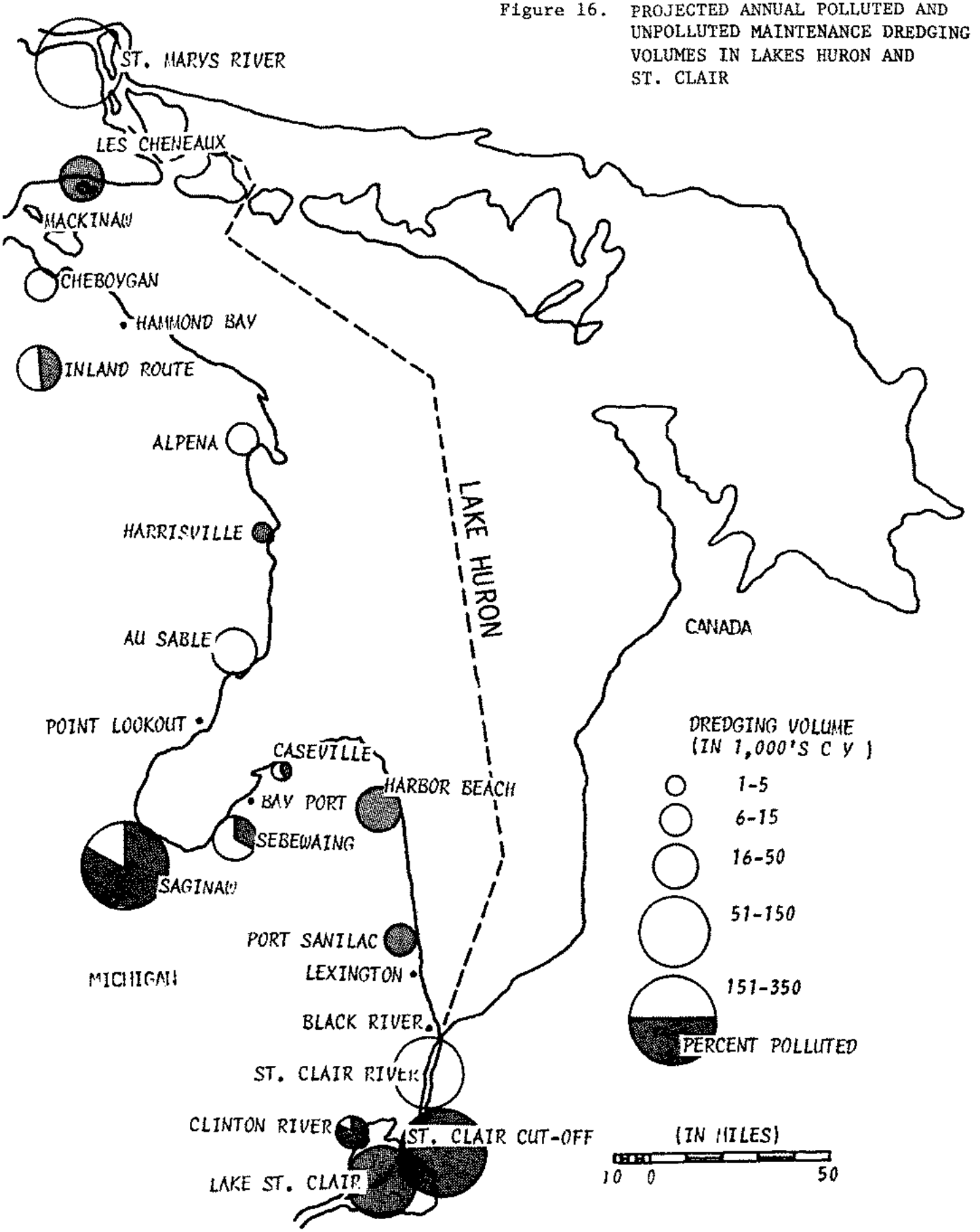


Table 62. ESTIMATED VOLUME OF FUTURE POLLUTED DREDGED SPOIL IN LAKE HURON/ST. CLAIR
(cubic yards)

| Project | Maintenance dredging | Percent polluted | Polluted volume |
|---|---|---|---|
| Alpena | 9,768 | 90 | 8,791 |
| Au Sable | 20,828 | 0 | 0 |
| Bay Port | 0 | 0 | 0 |
| Black River | 0 | 0 | 0 |
| Caseville | 3,236 | 40 | 1,294 |
| Ch. Lake St. Clair | 177,677 | 100 | 177,677 |
| Cheboygan | 11,614 | 0 | 0 |
| Clinton R. | 7,602 | 85 | 6,462 |
| Hammond Bay | 0 | 0 | 0 |
| Harbor Beach | 32,083 | 100 | 32,083 |
| Harrisville | 3,453 | 100 | 3,453 |
| Inland Route | 22,611 | 50 | 11,306 |
| Les Cheneaux | 20,545 | 100 | 20,545 |
| Lexington | - | Not sampled | - |
| Mackinaw | 0 | 0 | 0 |
| Point Lookout | 0 | 100 | 0 |
| Port Sanilac | 6,973 | 100 | 6,973 |
| Saginaw | 334,871 | 85 | 284,640 |
| St. Clair R. | 108,513 | 0 | 0 |
| St. Marys R. | 243,824 | 0 | 0 |
| Sebewaing | 24,160 | 33 | 8,053 |
| Totals | 967,758 | | 501,277 (52%) |

The confined disposal site for dredgings from Lake St. Clair is firm and a final Environmental Impact Statement has been prepared in April 1974. No foreseeable problems, other than the property purchase for the confined site on the St. Clair delta, are anticipated there at this time.

It may be expected that, based on an annual maintenance dredging projection of 967,768 cubic yards in Lake Huron and Lake St. Clair, 52 percent of the volume will not meet the sediment quality criteria of the E.P.A. Future annual maintenance dredging is anticipated to increase by 200,000 cubic yards over the 1961-1970 decade, however the volume of polluted spoil will increase by 85,000 cubic yards. If no sediment abatement programs are initiated and the E.P.A. upholds its present sediment quality criteria, it may be expected that between 45 and 72 percent of future maintenance dredging will not qualify for open-lake disposal. However, based on a projection of the principal projects (Table 61) and individual projects (Table 62) it appears that approximately 55 percent of the spoil to be removed in the future will be polluted. In most projects confined disposal facilities under PL 91-611 are to be constructed in the next 2 to 3 years (Table 58), suggesting that polluted sediments will be confined in the prepared sites by 1977 and dredging activity and hence volumes will increase at that time.

In Ontario, investigations by the M.O.E. are not as complete in terms of the number of harbors sampled as in Michigan. However, of the 14 sampled projects in Lake Huron, 7 exceed the recommended criteria of the M.O.E. (Figure 15). Although the M.O.E. as yet does not classify navigation projects as polluted and unpolluted, in this lake, it is assumed that if the criteria are exceeded the project is polluted. Between 1961 and 1970 maintenance dredging averaged 278,000 cubic yards annually. Assuming that the D.P.W. projects sampled exceeded the M.O.E. criteria, then as now, and the remaining projects did not exceed the criteria, approximately 135,000 cubic yards or 49 percent of the dredgings were polluted. Table 63 represents the future maintenance dredging in Lake

Table 63. FUTURE DREDGING BY D.P.W. IN LAKE HURON/ST. CLAIR AND PROJECTED VOLUME OF POLLUTED SPOIL (48, 54) 1973-1977 (cubic yards)

| Project | Total volume | Sediment quality |
|---|---|---|
| Belle River | 26,000 | n.s.[a] |
| Byng Inlet | 48,874 | n.s. |
| Cedar Beach | 7,000 | n.s. |
| Collingwood | 70,000 | n.s. |
| Goderich | 70,000 | Polluted |
| Grand Bend | 40,000 | Polluted |
| Kincardine | 15,000 | n.s. |
| Midland | 5,000 | n.s. |
| Oliphant | 10,000 | n.s. |
| Pike Creek | 16,000 | n.s. |
| St. Clair Cut-off | 1,200,000 | Polluted |
| Sault Ste. Marie | 26,000 | Polluted |
| Sarnia | 26,000 | Polluted |
| Sydenham | 28,000 | n.s. |
| Total | 1,587,874 | of which 1,362,000 (85%) exceed M.O.E. criteria |

[a] n.s. not sampled.

Huron and the sediment quality of sampled areas. If the projects which are not sampled do not exceed the M.O.E. criteria, it may be concluded that 85 percent of the dredgings in Canadian projects are polluted. Approximately 1.2 million cubic yards of polluted sediment is located at Sault Ste. Marie and in the St. Clair Waterway. The D.P.W. is presently constructing and testing a diked disposal area at Mitchell Bay in Lake St. Clair. It is therefore anticipated that a confined site will be

prepared to receive dredgings from the St. Clair Cut-off in the near future.

As can be seen from the data above, an unbiased estimate of polluted dredged spoil cannot be determined for Canadian projects in Lake Huron/ St. Clair. If the M.O.E. criteria are exceeded, confinement of spoil does not necessarily follow. At Sault Ste. Marie open-lake disposal has recently occurred at Gros Cap. Very few of the approximately 50 projects in Ontario have been sampled. Only when all the projects are sampled can accurate assessments of polluted volumes be made. However, based on available data, thus far, it appears that the percent polluted spoil in Ontario is comparable to that of Michigan.

Summary

Based on data in this section and Section III the following have been determined:

1. Of the 30 sampled harbors in Lake Huron, 10 are not polluted.

2. Pollution parameters most often exceeded in C.E. dredging projects are COD, volatile solids, and Kjeldahl nitrogen. In D.P.W. projects, Kjeldahl nitrogen and COD are the most commonly exceeded parameters.

3. Polluted sediments are not exclusively limited to river harbors. Harbors on the lake front (e.g., Harrisville, Port Sanilac) are also polluted.

4. Polluted dredged spoil in C.E. projects in 1972 and 1973 was 42 and 53 percent respectively.

5. The quantity of polluted dredged spoil in the last decade is approximately the same as the volume to be dredged in the future (57% vs. 52%).

6. If the C.E. were to dredge 1.2 million cubic yards annually, as they have projected, 72 percent of the dredgings would be polluted.

7. Based on an annual projection of 0.9 million cubic yards, approximately 52 percent of the spoil would be polluted.

8. Although future annual maintenance dredging is anticipated to increase by about 200,000 cubic yards over the past decade, the quantity of polluted sediments will increase by only 85,000 cubic yards.

9. High maintenance dredging projects, such as the St. Clair River, Au Sable and St. Marys River, are not necessarily equated with high volumes of polluted spoil.

10. The largest volume of polluted spoil (90%) in the next decade will be dredged from Lake St. Clair and from Saginaw.

11. Saginaw, where dredging of polluted spoil has been delayed, faces the most serious problem in terms of confined disposal. A site for Lake St. Clair's polluted spoil is firm at this time. Confined sites for all polluted projects under PL 91-611, with the exception of Port Austin, are also firm.

12. Based on available data, 85 percent of the future dredging volumes in Ontario will be polluted. Most of this quantity (1.2 million cubic yards) will be removed from the St. Clair Cut-off.

## QUANTITY OF POLLUTED DREDGED SPOIL IN LAKE MICHIGAN

Based on the Environmental Protection Agency's 7 mandatory pollution parameters, the current pollution analyses of public harbor sediments in the dredging areas are indicated in Table 64. Sediments of private harbors have not been routinely sampled, therefore private harbors are not treated herein. The E.P.A. usually samples the public harbors prior to the scheduling of maintenance dredging. A total of 327 bottom samples were taken, for an average of 7.4 samples per public harbor. Though Milwaukee Harbor was re-sampled in 1973 and St. Joseph in 1974, the analyses data were not available.

Table 64. POLLUTION OF PUBLIC HARBORS IN LAKE MICHIGAN BY PARAMETER BY C.E. DISTRICT (55)

| Harbor | Year sampled | No. of samples | Criteria limits exceeded | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Vol. sol. | COD | Kjel. N | Oil & grease | Hg | Pb | Zn |
| Algoma | 1969 | 8 | | | x | | nt | | |
| Big Suamico | 1970 | 5 | x | x | x | | | | x |
| Burns Waterway | 1970 | 5 | x | | | | | x | x |
| Calumet H. & R. | 1968 | 4 | x | x | x | x | nt | x | x |
| Chicago Hbr. | 1971 | 6 | x | x | nt | x | | x | x |
| Chicago River | 1968 | 5 | x | x | nt | x | nt | nt | nt |
| Gladstone–Kipling | 1970 | 5 | | | | | | | |
| Green Bay | 1969 | 36 | x | x | x | x | nt | x | x |
| Indiana | 1967 | 11 | x | nt | x | x | nt | x | x |
| Kenosha | 1973 | 8 | x | x | x | x | x | x | x |
| Kewaunee | 1969 | 15 | x | x | x | x | nt | | x |
| Manitowoc | 1969 | 23 | x | x | x | x | nt | x | x |
| Menominee | 1969 | 17 | x | x | x | x | nt | x | x |
| Michigan City | 1970 | 7 | x | x | x | x | x | x | x |
| Milwaukee | 1968 | 9 | x | x | x | x | nt | x | x |
| New Buffalo[a] | 1968 | 4 | | | x | | nt | | |
| Oconto | 1968 | 2 | | | | | nt | | |
| Pensaukee | 1968 | 4 | | x | x | x | nt | | |
| Port Washington | 1971 | 8 | x | x | | | | x | x |
| Racine | 1973 | 13 | x | x | x | x | x | x | x |
| Sheboygan | 1969 | 18 | x | x | x | x | nt | x | x |
| Sturgeon Bay/ Ship Canal | 1969 | 16 | x | x | x | x | nt | x | x |
| Two Rivers | 1969 | 15 | x | x | x | x | nt | x | x |
| Waukegan | 1973 | 9 | x | x | x | x | x | x | x |
| Total samples | | 253 | | | | | | | |
| Percent of harbors polluted by each parameter | | | 79 | 75 | 75 | 70 | - | 67 | 75 |

Table 64. (continued)

| Harbor | Year sampled | No. of samples | Criteria limits exceeded | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Vol. sol. | COD | Kjel. N | Oil & grease | Hg | Pb | Zn |
| Arcadia | Not sampled | | | | | | | | |
| Charlevoix | 1971 | 3 | | | nt | | | | |
| Frankfurt | 1972 | 6 | x | x | x | x | nt | nt | nt |
| Grand Haven | 1972 | 7 | x | x | x | x | nt | nt | nt |
| Grays Reef | Not sampled | | | | | | | | |
| Holland | 1972 | 7 | x | x | x | x | nt | nt | nt |
| Leland | 1971 | 2 | | | nt | | | | |
| Ludington | 1967 | 4 | | nt | | | nt | nt | nt |
| Manistee | 1967 | 4 | | nt | | | nt | nt | nt |
| Manistique | 1967 | 3 | x | nt | | x | nt | nt | nt |
| Muskegon | 1967 | 3 | | nt | | | nt | nt | nt |
| Pentwater | 1967 | 15 | | nt | | | nt | nt | nt |
| Petoskey | Not sampled | | | | | | | | |
| Portage Lake | 1971 | 2 | | | nt | | | | |
| Saugatuck | 1967 | 1 | | nt | nt | nt | nt | nt | nt |
| South Haven | 1972 | 7 | x | x | x | x | nt | nt | nt |
| St. James | Not sampled | | | | | | | | |
| St. Joseph | 1972 | 6 | x | x | | x | nt | nt | nt |
| Traverse City | 1972 | 2 | x | | nt | | | | x |
| White Lake | 1967 | 2 | | nt | | | nt | nt | nt |
| Total samples | | 74 | | | | | | | |
| Percent of harbors polluted by each parameter | | | 35 | 25 | 20 | 30 | - | - | - |
| Total for lake | | | | | | | | | |
| Percent of harbors polluted by each parameter | | | 59 | 52 | 50 | 52 | - | - | - |

[a]New public harbor.
nt Not tested; x Parameter exceeded limits

Pollution classifications for each harbor are presented in Table 65. Of the 42 public harbors in Lake Michigan, 15 are classified as unpolluted, 10 are polluted, while the remaining 17 have been designated as partially polluted (P/U). In addition, New Buffalo, a project which is to be expanded soon into a new public recreational harbor, has already been sampled and is classified herein as partially polluted. Arcadia, Grays Reef, Petoskey, and St. James have not been sampled, but these harbors are not regarded as polluted.

The P/U classification is employed when the inner harbor contains polluted sediments while the outer harbor area is 'clean.' In some harbors such as Frankfurt and South Haven, the boundary between the polluted and unpolluted portions is located well inside the inner harbor. Other partially polluted harbors, for example, Sheboygan, Kenosha, and Waukegan, are polluted throughout except near the jetty and/or breakwater. Sturgeon Bay Harbor, which has an unusual design due to the ship canal, is polluted only in the vicinity of the city.

The most seriously polluted harbors are located in the Chicago District and include Calumet, Chicago Harbor and River, Green Bay, Indiana, Kewaunee, Manitowoc, Milwaukee, and Racine. Pollution of these harbors (Figure 17) is promoted by the large industrial and urban complexes adjacent to the navigation facilities. Conversely, most of the recreational harbors, as in the Detroit District, are not polluted. Based on the data available, parameters that most frequently exceeded the criteria limits included volatile solids and COD. In Kenosha, Michigan City, Racine, and Waukegan Harbors mercury was found in excess of its limits. Prior to 1970-1971, mercury was not considered to pose a problem, hence it was not routinely tested until after that time.

As indicated in Table 64, analyses of the harbor sediments are not complete, especially for the Detroit District. In this district many samples were not analyzed for mercury, lead or zinc concentrations. Saugatuck was classified on the basis of one sample from which only one

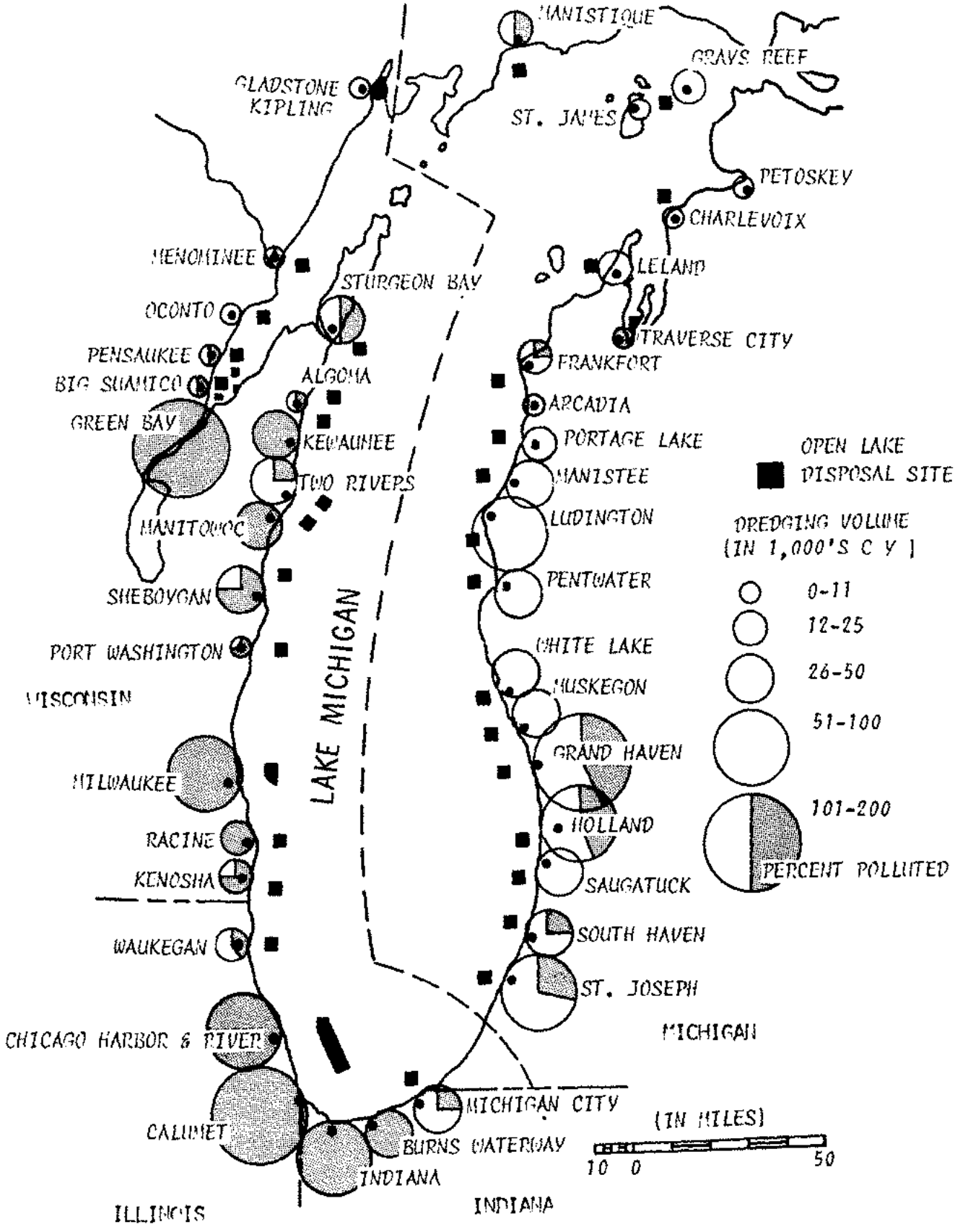



Figure 17. POLLUTED QUANTITY OF FUTURE AVERAGE ANNUAL MAINTENANCE DREDGINGS AND LOCATION OF OPEN-LAKE DISPOSAL SITES IN LAKE MICHIGAN

parameter was analyzed. In addition, COD and total Kjeldahl nitrogen were frequently omitted in the analyses of samples from this district. With the exception of mercury, analyses in the Chicago District are more complete. Pollution data for Ludington, Manistee, Muskegon, Pentwater, Saugatuck, Sheboygan, and White Lake Harbors are several years old, hence resampling may be in order.

At the specific request of the C.E., Waukegan Harbor was resampled in 1973. The analyses revealed that the outer harbor sediments near the breakwater were unpolluted. The resampling of Waukegan Harbor has emphasized the fact that many harbors are unpolluted in the outer harbor areas near the jetties and breakwaters where littoral currents are the main source of sediments. It is also being recognized that pollutants have a horizontal, vertical and seasonal distribution, and that background pollution can be produced by tree leaves and marsh drainage.

## Future Quantity of Polluted Harbor Sediments

As illustrated in Table 65, a total of 28 harbors in Lake Michigan have been classified as polluted or partially polluted. Although New Buffalo Harbor has already been sampled, construction of this new recreational facility has not been completed. In an effort to determine the future average annual quantity of polluted dredged sediments, each partially polluted harbor was subdivided into unpolluted and polluted sections. This subdivision was based on the distribution of polluted samples within the dredging areas analyzed by the E.P.A. If all bottom samples taken from a given harbor, such as Indiana, exceeded one or more of the pollution parameter limits, then all spoil (i.e., 100 percent) dredged from that harbor was considered polluted.

Because maintenance dredging operations, as compared to new work, frequently involved polluted sediments, only the percentage of the average annual maintenance dredgings that may be polluted was estimated for each

Table 65. FUTURE AVERAGE ANNUAL QUANTITY OF POLLUTED MAINTENANCE DREDGING BY HARBOR BY C.E. DISTRICT IN LAKE MICHIGAN
(cubic yards)

| Harbor | Pollution class | Percent of maintenance spoil polluted | Future annual maintenance dredging | Future annual polluted spoil |
|---|---|---|---|---|
| Chicago District | | | | |
| Algoma | P/U | 50 | 1,400 | 700 |
| Big Suamico | P/U | 50 | 2,700 | 1,400 |
| Burns Waterway | P | 100 | 30,000 | 30,000 |
| Calumet H. & R. | P | 100 | 113,800 | 113,800 |
| Chicago Hbr. & R. | P | 100 | 84,400 | 84,400 |
| Gladstone-Kipling | U | 0 | 3,000 | 0 |
| Green Bay | P | 100 | 156,100 | 156,100 |
| Indiana | P | 100 | 97,200 | 97,200 |
| Kenosha | P/U | 75 | 20,000 | 15,000 |
| Kewaunee | P | 100 | 38,000 | 38,000 |
| Manitowoc | P | 100 | 36,900 | 36,900 |
| Menominee | P/U | 60 | 7,900 | 4,700 |
| Michigan City | P/U | 25 | 36,100 | 9,000 |
| Milwaukee | P | 100 | 53,200 | 53,200 |
| New Buffalo[a] | P/U | 20 | 10,000 | 2,000 |
| Oconto | U | 0 | 2,200 | 0 |
| Pensaukee | P/U | 50 | 1,400 | 700 |
| Port Washington | P/U | 75 | 5,900 | 4,400 |
| Racine | P | 100 | 21,900 | 21,900 |
| Sheboygan | P/U | 75 | 33,100 | 24,800 |
| Sturgeon Bay/ Ship Canal | P/U | 50 | 42,200 | 21,100 |
| Two Rivers | P/U | 25 | 40,100 | 10,000 |
| Waukegan | P/U | 40 | 25,000 | 10,000 |
| Totals | | | 862,500 | 716,300 |

Table 65. (continued)

| Harbor | Pollution class | Percent of maintenance spoil/ polluted | Future annual maintenance dredging | Future annual polluted spoil |
|---|---|---|---|---|
| Detroit District | | | | |
| Arcadia | U | 0 | 0 | 0 |
| Charlevoix | U | 0 | 6,100 | 0 |
| Frankfurt | P/U | 25 | 23,100 | 5,800 |
| Grand Haven | P/U | 45 | 130,800 | 58,900 |
| Grays Reef | U | 0 | 21,900 | 0 |
| Holland | P/U | 45 | 73,700 | 33,200 |
| Leland | U | 0 | 12,600 | 0 |
| Ludington | U | 0 | 31,600 | 0 |
| Manistee | U | 0 | 34,800 | 0 |
| Manistique | P/U | 50 | 11,900 | 6,000 |
| Muskegon | U | 0 | 49,200 | 0 |
| Pentwater | U | 0 | 42,500 | 0 |
| Petoskey | U | 0 | 0 | 0 |
| Portage Lake | U | 0 | 16,000 | 0 |
| Saugatuck | U | 0 | 50,300 | 0 |
| South Haven | P/U | 25 | 40,000 | 10,000 |
| St. James (Beaver Island) | U | 0 | 1,500 | 0 |
| St. Joseph | P/U | 30 | 54,900 | 16,500 |
| Traverse City | P | 100 | 1,500 | 1,500 |
| White Lake | U | 0 | 26,500 | 0 |
| Totals for District | | | 628,900 | 131,900 |
| Totals for lake | | | 1,491,400 | 848,200 |

[a]New harbor to be constructed.

U Harbor unpolluted, P/U Harbor partially polluted, P Harbor polluted.

harbor. These estimations, which are preliminary, are presented in Table 65. The percentages were derived by comparing the spatial distribution of polluted harbor bottom samples with the volumes of maintenance dredging that are extracted from the various areas of the harbor. Since the Corps of Engineers' dredging records do not reflect the quantities dredged from the various harbor areas, the percentages must be regarded as first-order approximations.

In the Chicago District the total future average annual quantity of polluted maintenance dredgings has been estimated to be 716,300 cubic yards place measure. This volume, which is 83 percent of the total projected quantity of maintenance dredging (i.e., 862,500 CY), reflects the relatively large number of polluted and partially polluted harbors in that district. Calumet Harbor and River, Chicago Harbor and River, Green Bay, Indiana, and Milwaukee Harbors are all projected to yield over 50,000 cubic yards annually of polluted spoil (Figure 17). Because of the relatively long flow-through time of water in the Lake Michigan basin, disposal of large quantities of polluted spoil in the open lake may have an unacceptable impact on the water quality and algal growth in southern Lake Michigan. In the Detroit District, only 21 percent of the total projected quantity of maintenance dredging (i.e., 628,900 CY) is estimated to involve polluted spoil. Grand Haven is the only harbor in that district which is anticipated to generate over 50,000 cubic yards annually of polluted spoil.

In accordance with Public Law 91-611, the C.E. is authorized to design and construct confined disposal facilities for the polluted public harbors in the Great Lakes. A summary of developments in the confined disposal program regarding the 27 polluted harbors in Lake Michigan is contained in Table 66. With the exception of Algoma, Big Suamico, Burns Waterway, Pensaukee, and Manistique, all the harbors listed are included in the Corps of Engineers' confined disposal program. Although the E.P.A. informed the C.E. that Algoma was unpolluted, one of the 2 bottom

Table 66. PLANNING OF CONFINED DISPOSAL SITES FOR POLLUTED PUBLIC HARBORS BY C.E. DISTRICT IN LAKE MICHIGAN (50, 52)

| Harbor | Waiver granted | Diked disposal site selected | Completion date of diked site | Confined site now in use |
|---|---|---|---|---|
| Chicago District | | | | |
| Algoma[a] | | | | |
| Big Suamico[b] | | | | x |
| Burns Waterway[a] | | | | |
| Calumet Harbor & R. | | | 1975 | x |
| Chicago Harbor & R. | | | 1975-76 | |
| Green Bay | | x | | x |
| Indiana | | x | | x |
| Kenosha | x | x | 1975 | |
| Kewaunee | x | x | 1975 | |
| Manitowoc | x | x | 1975 | |
| Menominee | | tentative | unknown | x |
| Michigan City | | x | | |
| Milwaukee | x | x | 1974-75 | |
| Pensaukee[a] | | | | |
| Port Washington | pending | x | 1974-75 | |
| Racine | x | x | 1975 | |
| Sheboygan | | x | 1975 | |
| Sturgeon Bay | | | 1975-76 | |
| Two Rivers | pending | x | 1975 | |
| Waukegan | x | x | 1975 | |
| Detroit District | | | | |
| Frankfurt | | | 1976 | |
| Grand Haven | x | x | 1974-75 | x |
| Holland | x | x | 1976 | x |
| Manistique[a] | | | | |
| South Haven | | | 1976 | |
| St. Joseph | | pending | 1976 | |
| Traverse City | | | 1976 | |

[a]Harbor not initially selected for the confined disposal program.
[b]Harbor dropped from the confined disposal program.

samples taken from the harbor is polluted. Big Suamico should be deleted from the table because it will not be maintenance dredged in the future by the C.E. Burns Waterway may not undergo maintenance dredging yet for another 3 to 4 years. Pensaukee and Manistique are small, recreational harbors with little dredging.

Seventeen of the 27 harbor projects listed in Table 66 have at least temporary solutions for the confinement of polluted dredged spoil. Calumet, Grand Haven, Green Bay, Big Suamico, Holland, Indiana, and Menominee all have confined land sites which have been or are presently in use. However, at Calumet Harbor and River, the site currently in use has been partially filled and only a year or so of capacity remains. A single 10-year confined site has been designed for Milwaukee and Port Washington, Kenosha and Racine, and for Manitowoc and Two Rivers. Small 10-year sites have already been built at Grand Haven and Holland. Construction of other facilities is currently underway at Grand Haven, Holland, Kenosha-Racine, and Milwaukee-Port Washington.

For a number of harbors with polluted sediments, only the preliminary stages of planning for 10-year confined sites has been completed. Some delays in the program appear to be the result of the reluctance of local interests to provide land to the C.E. for disposal sites. Local interest groups generally are not anxious to provide such land until waivers of the shared construction costs of the confined sites are granted. In most instances, site selection focuses on the immediate vicinity of the outer harbor areas. If land disposal sites are available and in operation, waivers and 10-year confined sites may not be required.

In the Chicago District, little progress has been made with regard to Algoma, Burns Waterway, Chicago Harbor and River, Pensaukee, and Sturgeon Bay Harbors. In the Detroit District, solutions have not been found for Frankfurt, Manistique, South Haven, St. Joseph, and Traverse City. Most of the confined disposal facilities are scheduled to be

constructed by 1975 and 1976. This construction schedule suggests that if open-lake disposal of polluted spoil is not adopted as an acceptable alternative, then maintenance dredging may be postponed in a number of harbors until other solutions are implemented.

Unpolluted sediments derived from maintenance dredging are currently being used for beach nourishment by the C.E. at Holland, Manistee, Michigan City, and Muskegon Harbors. Maintenance dredging of harbors receiving sediment from littoral drift may be reduced by redesigning the breakwater and/or by artificial bypassing with sand pumps.

Summary

Of the 42 public harbors in Lake Michigan, 27 are classified as polluted or partially polluted. Only 15 public harbors do not contain polluted bottom sediments in the dredging areas, hence are unpolluted. An average of 7 bottom samples were taken per harbor. Of the 7 mandatory pollution parameters, volatile solids, COD and oil and grease most frequently exceeded the acceptable limits. In a small number of harbors there is a need for resampling as the pollution analyses are several years old. Also, in several harbors the pollution analyses were not complete, especially with regard to the testing of mercury, lead, and zinc concentrations.

For the next decade, the total average annual volume of polluted maintenance dredging in Lake Michigan has been estimated to be 848,200 cubic yards. This figure is 57 percent of the total average annual maintenance dredging quantity. However, in the Chicago District, 83 percent of the maintenance dredgings are polluted. Private dredging quantities were not included in this projection because this spoil is usually confined on the permittee's land. New work dredgings were also excluded because new work materials usually consist of relatively clean glacial till and bedrock. Most of the polluted spoil is derived from industrialized-urbanized harbors, especially inner harbor areas, and not from

small, recreational harbors. If pollution elimination systems regarding municipal and industrial wastes continue to reduce artificial sedimentation, as in Calumet Harbor, then the future annual quantity of polluted maintenance dredgings is expected to decrease slightly.

With the exception of 5 harbors, all 27 of the polluted and partially polluted public harbors have been included in the C.E. confined disposal program. At present, 17 of the harbors with polluted bottom sediments have at least temporary solutions to the problem of confining polluted dredged spoil. As scheduled by the C.E., many of the confined disposal sites are to be built during the period 1974-1976. This schedule appears to be optimistic. Unless polluted spoil can be open-lake dumped or disposed in ways alternate to diked confinement, then future maintenance dredging of some harbors may have to be temporarily postponed. Because of the relatively large annual polluted maintenance dredging volumes in Calumet, Chicago Harbor and River, South Haven, St. Joseph and Sturgeon Bay Harbors, the lack of confined sites for these harbors is most serious. New E.P.A. guidelines regarding the disposal of dredged materials in inland waters (14), to be promulgated in 1975, may result in the re-evaluation of some harbor pollution classifications and in the resumption of open-lake disposal of small quantities of lightly polluted dredged spoil. If so, confined disposal sites may not be required for Algoma, Manistique, Pensaukee, and Traverse City Harbors.

## QUANTITY OF POLLUTED DREDGED SPOIL IN LAKE SUPERIOR

The geological setting and the nature of the shoreline environment of Lake Superior is unique to all of the other Great Lakes. The Lake Superior drainage basin encompasses the "iron country" and the "copper country" along the western and southern shores. The northern shoreline and its contributing drainage system is heavily forested. Natural effluent drainage from the mineralized bedrock areas contributes materially to the metallic ion concentration of river mouth harbor waters and

sediments (15). Discharge of these ions into Lake Superior raises the metallic ion concentration to anomalously high values as compared to the other Great Lakes. The well known counterclockwise gyre in Lake Superior tends to 'stream' the metalliferous constituents eastward along the United States coastline to cause a plume of metallic solution within the otherwise pristine waters of the lake. Although these natural contaminants are not quantitatively high, they are detectable in water and sediment analysis (16). It has been noted that zinc values, as well as copper values, in water analyses are ubiquitous and in some cases anomalously high. Zinc minerals are associated with the copper of the Keewenaw Region (17). Therefore, both elements can be expected from natural weathering, drainage and mine effluent. Several hundred square miles of copper and zinc bearing rock units underlie the glacial drift or are exposed at the surface throughout the south shore. This so called contamination or pollution by surface waters (and from the water table) is a natural phenomenon and should be recognized as such in setting the criteria of pollution for Lake Superior. It is recognized that a base level of metallic ion concentration in the waters of the south shore of Lake Superior probably exists and is beyond the control of man to alter. Pollution criteria for Lake Superior should be established independently of the other lakes, based upon norms determined from open-lake waters along the south shore.

The drainage systems of the north shore harbors, both United States and Canadian, discharge quite universally from heavily forested areas, predominantly coniferous. Normal stream waters in these systems are acidic (high pH) and often brown tinted with tannic acid and stains leached from the forest duff. Large quantities of leaves and conifer needles are transported to river mouth harbors where this organic matter becomes waterlogged and settles to bottom. During the halcyon days of logging and widespread fluming and booming of saw logs in these rivers and harbors, considerable quantities of saw logs, bark, natural pulp and sawdust were deposited in the quiet waters of north shore harbors.

Characteristically, most of the north shore harbors were dredged the first time as new work development to remove the accumulation of organic debris and whatever inorganic sediments were required to reach project depth. Most of the older and smaller harbors have not been dredged since their initial development work was completed. Removal of paper mill wastes, pulp and bark continues in those harbors where large mills have developed. A few examples are: Thunder Bay, Nipigon, Peninsula, and Michipicoten. Maintenance dredging in these harbors is sporadic. The dredging frequency is a function of the level of industrial production of paper products, and natural stream flushing action.

Decaying organic matter produces a high oxygen demand (COD value) and is typical of all of the north shore harbors. Again, a high COD value is a normal expectancy for these conditions and is one which can be little altered by the efforts of man. Sediment pollution criteria, specifically citing COD values should consider the norm of natural effluent in the streams of the north shore.

Natural inorganic sedimentation (clay, sand, silt and gravel) is virtually nonexistent in the north shore harbors by virtue of the fact that the drainage area is blanketed with a complete vegetative cover. Many north shore harbors have insufficient sediment covering bedrock to make a sediment sampling program possible (16).

Pollution of Sediments--Introduction

The C.E. in 1969 reported that 12 of the principal U.S. harbors of Lake Superior were considered unpolluted (1). Two were considered polluted on the basis of criteria then in use (Table 19, Sec. 6.9). The classification at that time listed the following harbors:

Lake Superior (1)

| Unpolluted | Polluted |
|---|---|
| Big Bay Harbor | Duluth |
| Black River Harbor | Superior |
| Cornucopia Harbor | |
| Grand Traverse | |
| Keweenaw Waterway | |
| Lac La Belle | |
| Little Lake | |
| Ontonogan | |
| Port Wing | |
| Presque Isle | |
| Saxon | |
| Whitefish Point Harbor | |

Classification based upon E.P.A. parameters (Table 17, Sec. 6.6)

Under the heading of "Magnitude of the Problem" (page 9.19, Sec. 9.6.1) of the C.E. report, a total annual volume of dredging is predicted to be about 11 million cubic yards (all lakes) per year, of which approximately 84 percent (9.24 million CY) is polluted. This volume was tabulated from 39 harbors which were considered polluted at that time. Six of these polluted harbors accounted for one half of the total volume of polluted spoils.

It should be noted that the 1969 C.E. study worked primarily with maintenance and new work dredge volumes. The report also observes that private dredging was not compiled, but could be estimated at about 10 percent of the total.

Pollution in Lake Superior Harbors
--U.S.

With the enactment of Public Law 91-611 and the establishment of E.P.A. criteria of pollution, harbors in all lakes have been undergoing extensive sampling and reclassification. The St. Paul District, for instance, has contracted with independent laboratories for investigations of

harbors in their jurisdiction. National Biocentrics Inc. has been working on most of the harbors in the district for 2 years. Reclassification, based upon the E.P.A. studies and those of independent laboratories, now indicates that 17 U.S. harbors show at least one parameter of pollution in excess of the tolerable limit. Thirteen harbors are currently classed as unpolluted (Figure 18).

It should be noted, however, that the total volume of sediment removed from each of the "polluted" harbors is not necessarily all polluted. Many of the Lake Superior harbor volumes are composed largely of lake bottom sediments, sand and gravel which have been transported by littoral drift, ice-shove and violent onshore wind storms. These materials are, for the most part, clean and eligible for open-lake dumping, whereas the classification of the harbor may be "Polluted," as determined, from sampling of the inner harbor reaches. Expanded studies are now underway, with more extensive sampling programs, to delineate the volumes of polluted spoil from the unpolluted. Several field seasons and several additional samples will be required to draw lines of demarcation between polluted areas and unpolluted areas of most harbors. Once this isolation of polluted sediment has been accomplished, then a far more accurate determination of spoil volume and disposal area capacity can be made.

Under present policy, open-lake dumping of polluted spoil is restricted. Constraints may be lifted for sediments from those parts of Lake Superior harbors which can be proven to be clean and free of deleterious contaminants.

Assuming that restrictions are relaxed and using sediment analyses available for known sampling locations in Lake Superior harbors, this report attempts to estimate the percentage of total dredge quantity of each harbor which must be committed to diked or on-land disposal areas.

Based upon activities in the 10-year representative period (1961-1970) and the average annual volume predictions derived from that history,

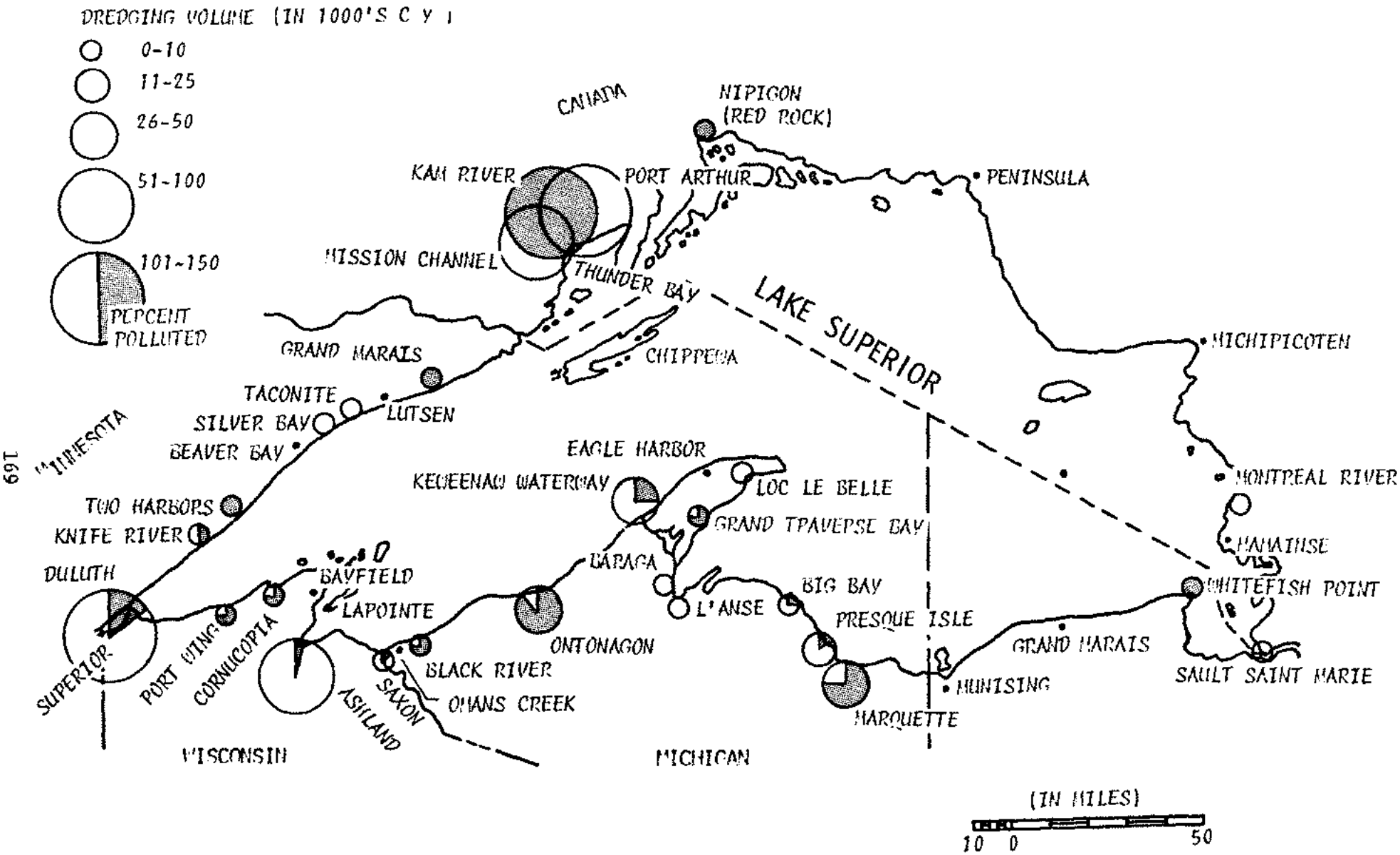



Figure 18. PROJECTED ANNUAL DREDGING VOLUMES IN LAKE SUPERIOR AND PERCENT POLLUTED (HARBORS WITHOUT VOLUMETRIC CIRCLES INDICATE NO PROJECTED DREDGING IN THE NEXT DECADE)

Table 67 is presented as a summary of this study and for comparison with the predictions of the C.E.

This study indicates a total annual average volume of 1,964,759 CY of spoil will be removed from United States harbors. Estimates of the percent of this volume which will be polluted and assigned to confined disposal are presented by harbor in the summary. Using data assembled, it appears that 236,883 CY or about 12 percent of the total spoil volume will require confinement (column 5). On March 15, 1973, the C.E. estimate of polluted spoil was reported as 206,100 CY, or approximately 1.5 percent less than this study found (column 4). The C.E. volume of 206,100 CY of polluted spoil is 10.5 percent of the total volume of sediment to be dredged (Table 67, column 4).

Using the estimates of the percent of sediment polluted in each harbor as determined in this study (column 7) and applying these values to the C.E. total annual volume projections, it is found that 159,430 CY may require confinement (column 3).

The discrepancy in polluted volumes, cited above, is apparently caused by differences in the appraisal of the size of areas of pollution within each harbor as identified by the C.E. and by this study, rather than in the total volume of sediment to be removed. It is recognized that under the present E.P.A. pollution policy, any harbor with one or more parameters showing an excess of contaminant, must be considered polluted. Many such determinations have been made, which require the C.E. to classify entire harbors polluted. Analyses assembled since 1969, extensive sampling projects and more detailed sediment mapping of harbors have made it possible to more accurately delineate polluted segments of harbors. This study has attempted to apply the current state of knowledge of polluted harbor areas, which was not available at the time of the last report of the C.E. As the sampling and testing program continues, it is anticipated that more and more realistic pollution volumes can be derived. These are expected to be considerably less than the initial estimates of polluted spoil volumes, made in 1970 and 1971.

Table 67. U.S. DREDGING IN LAKE SUPERIOR: TEN YEAR AVERAGE ANNUAL POLLUTED SPOIL AND AVERAGE VOLUME PREDICTIONS, 1961-1970
(cubic yards)

| Harbor (1) | Date sampled inclusive (2) | Polluted spoil predicted--U.S. % x C.E. vol. (3) | C.E. estimate (4) | This study (5) | Annual average (6) | % poll. (7) | Pol. class (8) |
|---|---|---|---|---|---|---|---|
| Angle Inlet | | | | | | 0 | U |
| Ashland | '69 | 2,000 | 2,000 | 2,000 | 60,619 | 100 | P |
| Baraga | | | | | 500 | 0 | U |
| Baudette | | | | | | 0 | U |
| Bayfield | '71,'72 | 1,000 | None | | | 100 | P |
| Big Bay | '70-'73 | 110 | 1,000 | 1,150 | 4,597 | 25 | P/U |
| Black River | '71-'73 | 1,000 | 3,000 | 1,826 | 2,435 | 75 | P/U |
| Chippewa | | | | | | 0 | U |
| Cornucopia | '71-'73 | 2,000 | 800 | 1,498 | 1,997 | 75 | P/U |
| Duluth-Superior | '70-'73 | 27,540 | 150,000 | 143,408 | 796,710 | 18 | P |
| Eagle Harbor | '68,'69 | | | | | 0 | |
| Grand Marais (Minn.) | '70-'73 | 3,000 | 600 | 600 | 600 | 100 | P |
| Grand Traverse | '71 | 3,750 | | 3,697 | 4,930 | 75 | P/U |
| Keweenaw Waterway | '70-'73 | 13,750 | 2,000-2,500 | 7,621 | 30,486 | 25 | P/U |
| Knife River | '70-'72 | 500 | 800 | 151 | 302 | 50 | P/U |
| Lac La Belle | '69,'72 | | | | 2,630 | 0 | U |
| L'Anse | | | | | 800 | 0 | U |
| La Pointe | '70 | | | | | 0 | U |
| Little Lake | '70-'71 | | | | 32,709 | 0 | U |
| Marquette | '71 | 750 | | 25,752 | 34,337 | 75 | P/U |
| Oman's Creek | | | | | 30 | 0 | U |
| Ontonagon | '68-'73 | 72,000 | 25,000 | 41,197 | 45,775 | 90 | P/U |
| Port Wing | '69-'73 | 3,750 | None | 2,926 | 3,902 | 75 | P/U |
| Presque Isle | '70-'73 | 850 | 2,000 | 2,000 | 11,810 | 17 | P/U |
| Saxon Harbor | '71-'73 | 440 | 700 | 700 | 6,291 | 11 | P/U |
| Silver Creek | | | | | 6,500 | 0 | U |
| Taconite | | | | | 200 | 0 | U |
| Two Harbors | '70-'73 | 20,000 | 200-600 | 767 | 767 | 100 | P |
| Warroad | | | | | 11,224 | 0 | U |
| Whitefish Pt. | '70,'71 | 6,000 | 6,000 | 1,590 | 1,590 | 100 | P/U |
| Annual totals | | 159,430 | 206,100 | 236,883 | 1,964,759 | | 5 P<br>12 P/U<br>13 U |

P Polluted; P/U Part polluted; U Unpolluted Harbor

Pollution of Lake Superior Harbors
--Canadian

Canadian harbors on Lake Superior are unusually clean as compared with U.S. harbors. Most of the pollution problem in Canada lies with the accumulation of wood pulp and the waste products of the paper industry in 2 harbors, namely Thunder Bay and Nipigon (Red Rock). The Public Works Commission of Canada (now D.P.W.) finds that inorganic sediments offer no particular pollution problem except in the aesthetics of disposal areas where clay and silt remain as suspensoids and tend to cloud the water for a short time after dumping in the open lake (18). The concern of the public and ecological interests in Ontario is more prominently directed toward the destruction of fish spawning areas and aquatic-life foraging areas than to the deleterious chemical effect of pollutants.

Inspection of Table 49 suggests that, of the average annual dredge volume in Canadian harbors (323,789 CY) some 40 percent or 130,752 CY will be polluted. On a 5-year projection, the D.P.W. suggests that 302,400 CY will be removed annually. Using the estimated total volume of polluted sediment from this study, per year, approximately 43 percent of the D.P.W. spoils will require confinement; a reasonably close agreement. Canadian port directors appear to have less of a problem with acquisition of land reclamation sites and diked disposal sites than their colleagues in the U.S., because of the differences between Canadian and U.S. real estate law (18).

Of the 10 principal harbors in Canada, as listed in Table 49, 3 are considered polluted by the M.O.E. Spoils from these are assigned to landfill projects. Canadian authorities have not yet delineated portions of harbors as polluted and unpolluted through extensive sampling programs. It is expected, however, that a large proportion of the current Canadian polluted sediments will be reclassified to unpolluted, with extensive sampling and analysis projects which are currently underway.

One of the reasons for the probable reclassification rests in the curious discovery that the dumping of organic wastes (pulp, bark, etc.) in the open lake, consistently improves the fishing, both commercial and recreational, in the dump area. This is probably a reflection of the increase in plankton and microbenthonic food supplies in the dump areas.

Table 49 shows an additional volume projected for Leigh Harbor, if proposed construction is consummated. This volume of sediment is not included in projections at this time since the project is still pending.

Statements of the D.P.W. in 1970, regarding the pollution of Canadian harbors, are quoted from the Dredging Inventory.

> "THUNDER BAY (KAM RIVER):
> At present, the O.W.R.C. has stated that all dredged material removed from that portion of the Kam River between the Westfort Turning Basin and Saskatchewan Pool Elevator #11, is unacceptable for open lake disposal because of high organic content and mercury contamination. A recent local newspaper report states that the lower extremity of the Kam is low in oxygen content and on the verge of being polluted. On the strength of this information, it is therefore necessary that for any future dredging in the Kam River, that all dredged material be deposited on a suitable land site.
>
> SAULT STE. MARIE:
> The 1,150,000 cu. yd. of sand and silt from the proposed deep water harbour at Leigh's Bay will be contained in an enclosed berm. The dredging will be done by hydraulic means which will cause some turbidity but proper engineered controls will be implemented.
>
> MICHIPICOTEN RIVER:
> In front of the public wharf is a silt island which if not sufficiently cleared out by the spring freshets will require dredging to maintain access to the wharf. The properties of this silt is not known, but it would cause considerable turbidity if dumped."

These quotations emphasize the nature of concerns of the Canadian dredging interests. Oxygen demand and turbidity (an aesthetic interest) are the principal deficiencies in most Canadian harbors.

Summary

1. Of 30 harbors sampled in the U.S. side of Lake Superior, 17 are classed as polluted or partially polluted and 13 are clean. In 9 Canadian harbors 3 are polluted and 6 are clean.

2. The most commonly occurring pollutants in U.S. projects are COD, Kjeldahl nitrogen, copper and zinc. In Canadian harbors, the pollutants are primarily COD and Kjeldahl nitrogen.

3. Approximately 10.5 percent of the total volume of dredge spoil in the U.S. harbors is polluted, according to predictions of the C.E. About 12 percent is polluted, as determined in this study.

4. Some 40 percent of the Canadian dredge spoils will be polluted in the next 10 years.

5. In the past decade, maintenance dredging removed 1,594,742 CY from U.S. harbors in Lake Superior. This is 15 percent of the 10,611,464 CY dredged from all Lake Superior harbors in all categories.

6. An adjusted average of new work volume for the 10-year period will be about 425,000 CY, in the U.S. annually

7. Permit dredging in Lake Superior during the historic period of record is 2.8 million CY or about 3 percent of the total for the same period. Adjusted averages, based on the 10-year sample period indicate about 191,000 CY will be removed annually.

8. Canadian maintenance is expected to average about 86,000 CY Per year.

9. Canadian new work and private dredging in the next decade is expected to be minimal, and thus insignificant to total volume figures.

10. Duluth-Superior dredging is predicted to be about 796,000 CY per year (41% of U.S. total) and the Thunder Bay area of Ontario, 315,482 CY (96% of total Canadian). These 2 projects are expected to produce the major percentage of all Lake Superior spoil volume.

11. Confined disposal sites in Lake Superior include 3 in Canada and 4 in the U.S. Fifteen U.S. projects were initially selected by the C.E. for their confined disposal program. However, as of July, 1974, only Ashland, Duluth-Superior, and Keweenaw remain in that program (Table 68).

Table 68. CONFINED DISPOSAL SITES FOR PUBLIC HARBORS IN LAKE SUPERIOR

| Harbor | Disposal site completion date | Status |
|---|---|---|
| Ashland | Start May 1974 | Pending litigation |
| Bayfield | -- | Dropped from program |
| Big Bay | -- | Dropped from program |
| Black River | -- | Dropped from program |
| Cornucopia | -- | Dropped from program |
| Duluth-Superior | Start April, 1974 new site | To award contract for 1,500,000 CY capacity |
| | Fill of old slips, 225 acres. 1975(?) | Possible new coal dock facility. See dredging section |
| Grand Marais (Minn.) | -- | Dropped from program |
| Grand Traverse[a] | -- | -- |
| Keweenaw Waterway | Spring 1975 | Pending |
| Knife River | -- | Dropped from program |
| Marquette | -- | Dropped from program |
| Ontonagon | Trucked inland | Disposed by local interests |
| Port Wing | -- | Dropped from program |
| Presque Ile | -- | Dropped from program |
| Saxon | -- | Dropped from program |
| Two Harbors | -- | Dropped from program |
| Whitefish Pt.[a] | -- | -- |
| Kam River | Operating landfill | Operating |
| Nipigon | Operating landfill | Operating |
| Port Arthur (Thunder Bay) | Operating landfill | Operating |
| (Keefer Terminal) | Landfill diked | Operating |

[a]Never selected for confined site program (PL 91-611).

SUMMARY OF POLLUTED DREDGED QUANTITIES

As of July, 1974, there were 62 public harbors and waterways in the C.E.'s 10-year confined disposal program (Tables 56, 58, 66 and 68). In Lake Ontario, Oswego and Rochester are also in the confined program. Site selection has been completed for 34 of these harbors and waterways. Although 16 harbors are utilizing existing disposal facilities, most are also going through site selection for the 10-year program. For 20 of the 62 projects, site selection has not been completed, nor are there existing disposal facilities. Among these harbors are Chicago Harbor & River, Clinton River, Oswego, St. Joseph, and Sturgeon Bay. However, the polluted quantity for these harbors totals only 300,000 CY annually, which is 5 percent of the total (6.45 CY).

Data in this report indicate that there are 80 public harbors and waterways on the American side of the Great Lakes with polluted bottom sediments. E.P.A. bottom sediment analyses reveal that, in addition to the 62 harbors already in the confined disposal program, the following also have polluted sediments: Algoma, Barcelona, Burns Waterway, Great Sodus, Harrisville, Manistique, Pensaukee, and Port Austin Harbors. In addition, the following harbors in Lake Superior as of July, 1974 have been dropped from the C.E. program: Big Bay, Black River, Cornucopia, Grand Marais (Minn.), Grand Traverse, Knife, Marquette, Port Wing, Saxon and Two Harbors. The total average annual volume of polluted spoil from these 18 additional harbors is only approximately 110,000 CY. With the exception of Burns Waterway, Great Sodus, and Marquette Harbors, these are small, partially polluted harbors which are infrequently dredged. The new pollution guidelines for dredged spoil currently being drafted by the E.P.A. will probably result in the reclassification of the pollution status of many of these smaller harbors.

Table 69 summarizes the polluted volume of average annual maintenance and private dredged spoil to be removed from harbors and waterways in the Great Lakes in the future.

Table 69. FUTURE AVERAGE ANNUAL QUANTITY OF POLLUTED DREDGED SPOIL IN THE GREAT LAKES
(cubic yards)

| Lake | Number of projects | | | Volumes of polluted spoil | | |
|---|---|---|---|---|---|---|
| | Total | Polluted | Unpolluted | United States | Canada | Total |
| Ontario | 5/6[a] | 3/6 | 2/0 | 330,000 | 475,000 | 805,000 |
| Erie | 21/5 | 21/5 | 0/0 | 4,500,000 | 125,000 | 4,625,000 |
| Huron/St. Clair | 20/10 | 13/7 | 7/3 | 532,400 | 276,000 | 808,400 |
| Michigan | 41 | 26 | 15 | 848,200 | -- | 848,200 |
| Superior | 30/10 | 17/3 | 13/7 | 236,883 | 130,752 | 367,635 |
| Totals | 117/31 | 80/21 | 37/10 | 6,447,483 | 1,006,752 | 7,454,235 |
| Percent of total | | | | 86% | 14% | |

[a]American harbors on left side of slash, Canadian on right.

1. The E.P.A. and the M.O.E. have determined the sediment quality of 148 navigation projects in the Great Lakes. This study reveals that 101, or 68 percent of the projects sampled are polluted or partially polluted.

2. It is estimated that future average annual maintenance dredging will involve the removal of 7,454,000 cubic yards of polluted spoil. Lake Erie, including the Detroit River, will account for about 62 percent of this total.

3. Of the 26 public harbors in Lake Erie, all are polluted or partially polluted. When considering volumes, the problem of polluted dredged spoil is basically an American one focused on Lake Erie, including the Detroit River.

4. The pollutants most frequently exceeded in United States harbors are volatile solids, COD, and oil and grease. In Canada, the principal parameters exceeding the M.O.E. criteria are COD and Kjeldahl nitrogen.

5. Based on the parameters most frequently exceeded, the principal sources of pollutants in the United States are from industrial and municipal effluents and agricultural fields. In Canada, pollutants are derived from lumber and paper industries, agricultural fields, as well as industrial and municipal effluents.

6. Where a harbor is divided into an inner and outer section, such as at Saginaw, usually the inner section is polluted whereas the outer section is clean.

7. In the United States, the 10-year confined site program of the C.E. (PL 91-611) involves 62 public harbors. At present, only for 34 harbors have disposal sites firmly selected. However, the E.P.A. analyses reveal that there are 80 U.S. public harbors and waterways in the Great Lakes with polluted bottom sediments.

8. Problems with the disposal of polluted dredged spoil may occur at Calumet, Chicago River and Harbor, Cleveland, Saginaw, South Haven, St. Joseph, and Sturgeon Bay Harbors.

9. Although sampling of bottom sediments is more thorough in Canadian navigation projects, less than one half of the harbors there have been sampled.

10. At present, the pollution criteria concerning dredged spoil in the United States and Canada are similar. However, the E.P.A. is currently drafting new pollution guidelines which may broaden the criteria for determining the eligibility of dredged spoil for open-lake disposal.

## SECTION V

## DREDGING AND DISPOSAL POLICIES

### UNITED STATES' POLICIES

The United States Army Corps of Engineers has been delegated the responsibility of maintaining the nation's federal waterways for approximately the last 150 years. The River and Harbor Act of 1899 authorizes the C.E. to develop, maintain, and improve the waterways and harbors of the United States in the interest of navigation. Since navigation may be obstructed in those waterways, no dredging or disposal of spoil may take place without approval by the C.E.

Non-federal interests who dredge and dispose of spoil must obtain a permit from the C.E. as specified in Section 10 of the River and Harbor Act. The initial purpose of Section 10 was to prevent obstructions to navigation, including dredging and disposal of spoil as well as construction projects like marinas, sea walls, power lines and submarine pipelines in navigable waters. Before approving a Section 10 dredging permit, the C.E. has the application reviewed by concerned state and federal agencies, such as state pollution control agencies, and the E.P.A. In its review of the Section 10 permits, the E.P.A. usually recommends approval provided that the applicant will confine the dredged spoil.

The original purpose of the River and Harbor Act concerned navigation. However, since the enactment of the National Environmental Policy Act

(NEPA) of 1969 (Public Law 91-190), effects on environmental quality have been given more attention. Section 102 of the NEPA act directs all federal agencies to prepare statements of environmental impact on all major actions, such as confined disposal sites, which may have a significant impact on the quality of the human environment. The act also specified, as national policy, additional guidelines of environmental quality and established the Council on Environmental Quality (CEQ) in the Executive Office of the President.

Perhaps the most comprehensive policy for improving the quality of the nation's waters is the Federal Water Pollution Control (FWPC) Act Amendments of 1972 (Public Law 92-500). This new law mandates a federal-state campaign to prevent, reduce, and eliminate water pollution by restoring and maintaining the chemical, physical, and biological integrity of the nation's waters. The primary goals of the law are: (1) by July 1, 1983, to have, wherever possible, water clean enough for swimming and other recreational uses, and clean enough for the protection and propagation of fish, shellfish, and wildlife; and (2) by 1985, to have no discharge of pollutants into the nation's waters. Whether "zero discharge" can become a reality by 1985 has been seriously questioned by the National Water Commission (19). However, the C.E. and local municipalities in the Chicago, Detroit, and Cleveland areas are presently assessing the problem of wastewater management (20). In southeastern Michigan, for example, a survey is being made to identify and evaluate: (1) different ways to collect and treat wastewater to help clean up the streams in an eight-county study area and hence reduce the amount of pollution entering Lakes Erie and St. Clair (Figure 5); and (2) different uses for treated wastewater and the material removed from this wastewater. The objectives are consistent with the goals and objectives of the FWPC Act Amendments of 1972.

Section 404 (a) and (b) of the FWPC Act Amendments of 1972 (PL 92-500) authorize the C.E. to issue permits, after public notice and opportunity for public hearings, for discharge of spoil into navigable waters at specified disposal sites. Section 404 (c) gives the Administrator of the E.P.A. the authority to approve such disposal sites in accordance with new guidelines regarding disposal of dredged materials in inland waters. These are presently being developed by the E.P.A. in conjunction with the C.E. However, if economic stress is to be avoided, the C.E., acting through the Chief of Engineers, may issue permits for disposal in any case where the new guidelines alone would prohibit the specification of a disposal site. This policy is reinforced by the Marine Protection, Research and Sanctuaries Act of 1972 (Public Law 92-532). The latter authorizes the Secretary of Commerce to designate those areas of the Great Lakes which have conservation, recreational, ecological or esthetic values as marine sanctuaries.

In 1969, the C.E. recommended legislation for the construction of diked disposal facilities for confinement of polluted spoil. This legislation, Public Law 91-611 of the River and Harbor Act, was enacted in 1970. Section 123 of this law is unique, as it is specifically designed for confinement of polluted spoil in a specific region, i.e., the Great Lakes. At that time, the Great Lakes region was the only area of the country where specific legislation had been enacted in the interest of pollution abatement in terms of confining spoil (21). At present, 62 federal harbors and waterways are in the confined disposal program of the C.E. Before a confined disposal site can be constructed, the C.E. is required by the National Environmental Policy Act of 1969 to submit an Environmental Impact Statement to the E.P.A. This policy has caused some delays in the selection and construction of many confined disposal sites.

Although Section 123 (C) of Public Law 91-611 provides for the construction and financing of 10-year containment sites for disposing of polluted dredged materials, it also specifies that non-federal interests: (1) furnish all lands, easements, and rights-of-way necessary for the construction, operation and maintenance of the facility; and (2) contribute 25 percent of the construction costs. The 25 percent shared cost may be waived by the C.E. if the E.P.A. determines that the municipalities and industries in the drainage basin are making satisfactory progress toward improving their waste treatment facilities. At present only 11 waivers of the shared construction costs have been granted while 8 others are pending by the C.E. Cost sharing has caused delays in the diked disposal program. Local interests, such as port commissions, are reluctant to provide land to the C.E. for diked disposal sites if waivers are not first granted. The Great Lakes Commission recommended to Congress in August, 1973, that waiver requirements be deleted because of possible economic stress in harbors such as Saginaw and Calumet (13).

Basically, Public Law 91-611 is a temporary solution to the problem of the disposal of polluted dredged spoil. Whether open-lake disposal can take place is determined, in part, on the state level. The governors of the states of Minnesota, Wisconsin, Illinois, Indiana, and Michigan have objected to open-lake disposal of polluted spoil dredged by the C.E. and by private dredging firms (22). However, the governors of Ohio, Pennsylvania and New York did not request that open-lake disposal of polluted spoil be discontinued in the Great Lakes. In the Buffalo District, open-lake dumping of polluted spoil is continuing at harbors where confined disposal sites are not yet available.

During the past three years the C.E. has expanded its role in the environmental field. The C.E. has recognized that coastal marshes and wetlands constitute productive and valuable public resources. Thus, no permit will be granted for work in wetlands unless the District Engineer, in the

public interest, concludes that the benefits of the proposed alteration outweigh the potential damage to the wetland resources. In addition, permits for non-federal dredging operations require the permitee to comply with the same standards as federal dredging operations with respect to turbidity, nature and location of approved spoil disposal areas, and other factors relating to protection of the environment.

## CANADIAN POLICIES

Under terms of the British North America Act (BNA), the federal government of Canada can legislate for the enforcement of water quality standards and control of pollution. Also, under Section 108 of the BNA Act, transfer of dredges and authority for river and lake improvements at the time of confederation seemed to emphasize that dredging was specifically intended to fall under federal jurisdiction. However, with the exception of the Navigable Waters Protection Act (NWPA), dredging and disposal policies are basically legislated on the provincial level. The Ontario Water Resources Act, ammended in 1972, is administered by the Ministry of the Environment of Ontario (formerly the Ontario Water Resources Commission) and prohibits the discharge of any material, which may impair water quality, into or near any lake, stream, or other water body.

Under the Environmental Protection Act of 1971, the discharge of any contaminant into the natural environment in an amount, concentration, or level in excess of that prescribed by regulations is prohibited. These regulations in the case of dredging are the Water Quality Guidelines for the Review of Proposed Dredging and Spoils Disposal Operation and are specified in Section IV. The Environmental Protection Act of 1971 also concerns disposal of dredged spoil. The Ministry of Environment (M.O.E.) prohibits spoil disposal on land or in water without a certificate of approval or a provisional certificate of approval. Both of these

instruments of legislation do not use explicit terms such as dredged spoil or dredgings. This implies that dredged spoil policies have not reached, until recently, the level of concern as in the United States. Based upon the present Canadian policies, quality of the environment and associated ecosystems are of primary concern. Economic stress on navigation and regional commerce, or its consequences, are not emphasized.

The Navigable Waters Protection Act (NWPA), R.S.C., 1970, is a federal statute instituted in October, 1969, and parallels the function of Section 10 of the United States' River and Harbor Act of 1899. It is designed to protect the public right to navigation by prohibiting the modification of navigable waters without the approval of the Ministry of Transport (M.O.T.). Thus, the NWPA protects navigation, not the environment. When a dredging permit is secured, additional approval must be obtained from the provincial M.O.E. and other interested provincial or municipal agencies. Although 'dredging' is not specified as such, one may presume that under Section 3, Part I, the term 'work,' defined as "any dumping of fill or excavation of materials from the bed of a navigable water," includes dredging. The M.O.E. does not issue permits, but it advises applicants as to what is considered acceptable within the terms of the Ontario Water Resources Act.

The federal government has delegated the administration of the federal Fisheries Act (Section 91 (12) of the BNA Act) to Ontario and several other provinces. Within this act, a general provision states that no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish. Deleterious substance, in this case, may conceivably include polluted and unpolluted dredged spoil.

Ancillary policies to the Canadian legislation include:

a. The Beds of Navigable Waters Act
b. Public Lands Act
c. The Conservation Authorities Act
d. The Beach Protection Act
e. Public Health Act

In an unpublished report, John MacLatchy of Environment Canada presented the following overview:

> "It is important to note that in the above mentioned provincial Acts there is no attempt to control the dredging itself, but rather the removal and disposal of the dredged material as it is related to water pollution and land use which are clearly matters of provincial jurisdiction. None of these statutes specifically refer to dredging, but rather refer to the disposal of any material regardless of its origin or the removal of material from beaches." (23).

It may be concluded that a lack of a single group of laws and regulations exists concerning Canadian dredging policies per se. However, many, if not all of the acts cited above, reveal that there are policies to control environmental effects of dredging and disposal in harbors and navigable waterways.

## CANADIAN-AMERICAN POLICIES

In 1970 the International Joint Commission voiced concern over the grave deterioration of water quality on both sides of the international boundary (24). An attempt to establish a unified effort to prevent further deterioration of water quality in the Great Lakes led, in 1972, to the Agreement between the United States of American and Canada on Great Lakes Water Quality. Annex 6, "Identification and Disposal of Polluted Dredged Spoil," of this agreement specifically draws attention to dredging activities in the Great Lakes. A United States-Canadian Task Force was established to review the existing dredging practices, including laws and regulations. This group has the specific objectives of developing compatible criteria for the characterization of polluted dredged spoil and recommending compatible programs governing the disposal of polluted spoil in open water. One of the significant principles upon which

the above recommendations are to be based is, "as soon as practicable, the disposal of polluted dredged spoil in open water should be carried out in a manner consistent with the achievement of the water quality objectives, and should be phased out." (25). As an interim measure, polluted spoil is to be disposed in confined areas if they are available. The U.S. Army C.E. and the D.P.W. of Canada must continue efforts to develop additional sites for confined disposal during this interim. In accordance with Public Law 91-611, Section 123, the C.E. has begun to implement this action (see Section IV of this report).

This agreement is unique in that it was designed for a specified drainage basin (the Great Lakes) on an international boundary and specifically concentrates on the identification of polluted spoil within that basin.

## DISCUSSION

In Canada, dredging of Great Lakes' projects is contracted to private firms (public tenders) which, in some instances, accounts for high dredging costs. It has been estimated by the D.P.W. that contract dredging is at least 42 percent more expensive than dredging performed by departmentally owned plants (26). If the C.E. were to contract all their maintenance dredging projects to private firms, costs could realistically triple. Such a policy may lead to a greater selectivity and priority of dredging.

Recently, the M.O.T. has assumed more of the dredging responsibility. Prior to the NWPA, private dredging was regulated by the D.P.W. However, this authority and the administration of public harbors have been transferred to the M.O.T. Also, if a harbor commission in Canada plans any new work dredging projects, a permit must be secured from the M.O.T. and other concerned agencies including the Ministry of Natural Resources and the M.O.E. A unique facet of the Canadian dredging regulations is a

'marina policy' developed in 1965 to assist in non-federal marina development (27). Under this policy the D.P.W. will dredge and provide sea walls and jetties for a private marina. Such marine work, however, is limited to the value of new construction being undertaken by the developer to serve the boating public. Therefore, in a sense the federal government will subsidize industries directly related to marine activity. Although the pollution guidelines in Canada are as stringent as those of the E.P.A., dredging and disposal policies in general reveal some degree of flexibility and encourage most dredging activity to be resourceful. Spoil may be deposited on private land with few restrictions. In many harbor areas, particularly along the lower Great Lakes, land reclamation projects, parks, and civic centers are constructed with dredged spoil. In Toronto Harbor, for example, locally derived spoil is being utilized for the construction of beaches, berms, and an aquatic park (28). Moreover, unpolluted materials in Toronto Harbor are used to form dikes into which polluted dredgings are placed.

In the United States such flexibility is less evident. Private dredging is not subsidized nor is disposal by federal plants allowed on private land unless the owner provides retaining dikes and pump-out facilities. Based on Public Law 91-611 the confined disposal sites are to be constructed on public land or land purchased by the government. Normally 25 percent of the construction costs of the confined site is to be paid by the local political entities. However, if the local municipalities and industries are developing or using pollutant elimination systems in accordance with Public Law 92-500, then they are considered in compliance with current water quality standards and a waiver may be obtained.

Perhaps the most pressing problem with the confined disposal program in the United States is the high capital costs of the construction and land availability for these sites. Although construction costs of a confined

disposal site range from 4 to 12 million dollars, the cost per cubic yard may be relatively low for a large site. The C.E. has determined that confinement of polluted dredged spoil from the 35 federal harbors having the highest annual maintenance dredging requirements may increase the cost by 3.5 times (1). Vacant land in harbor areas is extremely limited, particularly in industrialized projects where maintenance dredging volumes are high. In Canada, this problem has not reached a critical stage partly because maintenance dredging volumes in major projects such as Toronto and Hamilton are smaller. In the U.S. the policy for the confinement of polluted dredged spoil is ambitious; however, implementation is physically difficult and economically very costly.

Another new development which may affect spoil disposal in the near future in the United States is the new guidelines for dredged materials currently being drafted by the E.P.A. and reviewed by the C.E. (22). As discussed elsewhere, the E.P.A. pollution criteria have received constructive criticism (21). Based on the 5th draft of these new guidelines, which are to be finalized in 1975, the list of pollution parameters which determine the eligibility of dredged spoil for disposal in open waters of the Great Lakes will be expanded beyond the 7 mandatory parameters. These will include a wide range of pollutants such as insecticides, bacterial quality and toxic substances. A 'shake' or standard Elutriate Test will also be introduced to distinguish between contaminants in the dredged spoil and background pollutants occurring naturally in the lake waters. The draft guidelines specify that each harbor is to be considered individually and more completely. Sampling schedules have been prepared through 1976. All sampling analyses will be more complete in that subjective as well as chemical testing will be done on all samples taken.

The draft guidelines also indicate that less stress will be placed on the pollution capability of the dredged sediments per se and more emphasis on the potential impact of the spoil on the disposal area. The

following areas are not to be selected as sites for the diked proposal facilities:

a. Municipal water supply and intake areas
b. Shellfish beds and fishing areas, to include spawning and breeding areas
c. Wildlife areas
d. Recreational areas

Since 1970 a decline in maintenance dredging has occurred in public and private harbors of Lake Michigan and Lake Huron due to a lack of disposal sites for the confinement of polluted spoil.

The volume of dredged spoil and industrial waste such as fly ash disposed in wetlands of the Great Lakes is not known. Since wetlands are recognized as beneficial from many points of view, an assessment of the impact of private dredging and industrial disposal in such areas is recommended. For example, from Toledo Harbor northward to Lake St. Clair (Figure 5), C.E. confined disposal facilities are in use or being planned. The C.E. has designed offshore diked disposal areas for Toledo and for the Detroit and Rouge Rivers to accommodate dredgings from federal projects. However, power plants and industries are continuing to dispose industrial wastes and dredgings in limited onshore wetlands.

Spoil dredged from private harbors and adjacent to private docks in public harbors in the United States will continue to be confined on the permittee's own land or in alternate ways approved by the C.E. It is anticipated that in the future the C.E. will regulate private dredging operations more closely. Proposed Change 6 of the 1899 River and Harbor Act requires that the C.E. consider non-federal activities, including private dredging, in the planning and maintenance of federal projects. In addition, the permit applicant is to comply with the following: (1) the FWPC Amendments of 1972; (2) the Marine Protection, Research and Sanctuaries Act of 1972; and (3) the Coastal Zone Management Act of 1972 (Public Law 92-583). Although future private dredging volumes in Lakes Erie, Michigan and Ontario are expected to remain relatively high, some

decrease in dredging may result as waste treatment facilities reduce municipal and industrial deposition.

The C.E., in their pilot study of dredging, reported that the effects of open-lake disposal of dredged material had not been researched (1). At present the effect of open-lake disposal of dredged spoil on water quality is still in a research phase (29). Moreover, the C.E. concluded that in the future, at some of the harbors with low maintenance dredging requirements, small quantities of moderately polluted spoil may be disposed in the open lake (1). Although few confined disposal sites are available, most large volume projects such as Toledo and Buffalo do have confined facilities. If economic stress is to be avoided while permitting maintenance dredging, then open-lake disposal of small volumes of lightly polluted spoil could be a temporary solution to the problem of confining polluted dredged spoil. In emergency situations small volumes could be trucked to nearly landfill areas or confined behind earthen dikes.

# SECTION VI

# FACTORS RELATED TO DREDGING

## INTRODUCTION

Dredging and disposal of sediments from Great Lakes harbors are related to physical and economic activities. In this section sources of dredged material, lake levels, and future economic changes in the Great Lakes Basin are briefly discussed and their association with Great Lakes dredging activity examined.

## SOURCES OF DREDGED MATERIAL

Dredging is required to remove sediments which have accumulated in navigation channels in Great Lakes' harbors and waterways. The three main sources of the dredged sediments are: (1) stream sedimentation; (2) littoral drift; and (3) industrial and municipal discharges. The sources of sediments vary from harbor to harbor and depend upon harbor site and design. In most instances the sediments are unconsolidated and can be removed with a hydraulic or mechanical dredge. Occasionally bedrock is encountered (Class A material in Canada) such as in the Amherstburg Channel in the Detroit River. Harbors such as Saginaw and Green Bay receive large quantities of sediment from the drainage basin. Other projects, such as Ashtabula and Hamilton, are located on the lake front where sediments are transported by longshore currents which introduce sediment into the harbors. Here the detritus is derived directly from

the nearshore area and is usually comprised of sand-sized particles. A third source of harbor sediments is from industrial and municipal effluents as noted in Buffalo and Cleveland Harbors.

Although there is a variety of glacial drift and bedrock in the Great Lakes region, sediment transport by streams tributary to the lakes is generally low. The surface geology of the Great Lakes region is largely composed of unconsolidated glacial deposits. However, in much of Ontario the glacial drift is thin or absent exposing the ancient Precambrian Shield. Stream concentrations of suspended sediments, in the Great Lakes region, are usually less than 270 parts per million. A notable exception is the Maumee River basin where concentrations ranging between 270 and 1900 parts per million have been determined (30). By comparison, in the American southwest suspended load concentrations are often in excess of 1900 parts per million. As a whole, the Great Lakes basin contributes only 0.4 percent of the nation's total sediment volume to the oceans (31).

Factors other than sediment or soil composition will influence the amount of sediment contributed by streams to the lakes. Table 70 illustrates land use in the Great Lakes basin. As indicated, almost one half of the basin is characterized by forested land which, in part, accounts for the

Table 70. LAND USE IN THE GREAT LAKES BASIN (31)
(percent)

| Land use | Percent of area |
|---|---|
| Forest | 47.4 |
| Agriculture | 38.4 |
| Urban | 8.4 |
| Other | 5.8 |

low erosion rates, hence low sediment yields of streams therein. The most significant source of sediment for the basin is the cultivated agricultural land (Table 71).

Table 71. ESTIMATED SEDIMENT SOURCES FOR THE GREAT LAKES BASIN (31) (Percent)

| Sources | Percent of Total Sediments |
|---|---|
| Agricultural land sheet erosion | 37 |
| Geologic erosion | 30 |
| Range and forest | 10 |
| Construction sites, roadsides, and development sites | 10 |
| Streamland, flood basin erosion | 8 |
| Gully erosion | 5 |

The lack of sediment transport into the Great Lakes by tributary streams is reflected in the morphology of many coastal areas of the basin. Normally where great volumes of sediment are introduced to a coastal zone, deltas, coastal plains, and extensive marshlands characterize the coast. With few exceptions, considering the length of the Great Lakes' shoreline, such features are uncommon. Thus, in part, due to the low sedimentation rates of streams tributary to the Great Lakes, dredging volumes are relatively low.

Rivers contribute sediments to river mouth harbors. Although stream data are available for many rivers in the Great Lakes region, it is difficult to equate stream sediment loads to maintenance dredging volumes. In Table 72, pertaining to river mouth harbors, estimated stream loads derived from upland sources in tons per year and mean annual maintenance

Table 72. A COMPARISON OF RIVER SEDIMENTATION AND MAINTENANCE DREDGING IN SELECTED PROJECTS (7, 50)

| Project | Stream load (tons/yr) | C.E. maintenance dredging (cubic yards) | Conversion 1 CY=0.675 tons |
|---|---|---|---|
| Lake Superior | | | |
| Ashland | 10,240 | 2,000 | 1,350 |
| Duluth/Superior | 14,410 | 120,000 | 81,000 |
| Ontonagon | 5,130 | 30,000 | 20,250 |
| Lake Michigan | | | |
| Manistee | 26,800 | 50,000 | 33,750 |
| Manistique | 3,250 | 10,000 | 6,750 |
| Manitowoc | 44,000 | 40,000 | 27,000 |
| Menominee | 26,000 | 8,000 | 5,400 |
| Oconto | 33,000 | 4,000 | 2,700 |
| Racine | 34,969 | 30,000 | 20,250 |
| St. Joseph | 255,000 | 87,000 | 58,725 |
| Lake Huron | | | |
| Alpena | 9,540 | 10,000 | 6,750 |
| Au Sable | 7,800 | 30,000 | 20,250 |
| Clinton R. | 48,000 | 30,000 | 20,250 |
| Saginaw | 135,800 | 500,000 | 337,500 |
| Lake Erie | | | |
| Buffalo | 23,000 | 600,000 | 405,000 |
| Cleveland | 200,456 | 1,220,000 | 823,500 |
| Fairport | 22,500 | 400,000 | 270,000 |
| Lorain | 67,100 | 300,000 | 202,500 |
| Monroe | 118,800 | 200,000 | 135,000 |
| Port Clinton | 89,000 | 10,000 | 6,750 |
| Toledo | 1,179,000 | 1,250,000 | 843,750 |
| Lake Ontario | | | |
| Oswego | 136,500 | 80,000 | 54,000 |
| Rochester | 76,100 | 360,000 | 243,000 |
| | 2,566,395 | 5,371,000 | 3,625,425 |

dredging volumes (1961-1970) are compared. If it is assumed that a dry weight of sediment averages 50 pounds per cubic foot (32), then the volume of sediment can be converted to tons. As illustrated in Table 72, some general compatibility between sediment yield and average annual maintenance dredging is evident, particularly in harbors where dredging volumes and sediment yields are low (i.e., Manistee and Racine). However discrepancies are equally obvious, especially in Lake Ontario and Lake Erie where, as in Buffalo, Lorain, and Rochester Harbors, average annual maintenance dredging volumes greatly exceed the annual sediment load. An explanation, recognized by the Great Lakes Basin Commission, is that the assumed density of the dredged material could be too high (32). Another possibility is that sediments derived from littoral drift accumulate in outer harbors and approach channels (i.e., Cleveland, Oswego). Perhaps more important, in some river mouth harbors, such as Cleveland and Buffalo, sediment sources from industrial and municipal effluent may be considerable. Thus, in many river mouth harbors sediment sources other than or in addition to stream transport are significant. Also, based on data in Table 72, open-lake disposal of dredged spoil may in some areas significantly accelerate sedimentation in the Great Lakes Basin. Prior to the turn of the century, many harbors were located in estuaries a short distance from the lake. However, through decades of expansion, harbor facilities have expanded upriver as well as along the coast. A number of commercial harbors in the Great Lakes today have this dual characteristic (e.g., Buffalo, Cleveland, and Thunder Bay). Thus, the sediment sources may be derived from stream deposition and littoral transport as well.

Harbors, such as Buffalo, are located on the lake front where sediments are transported by longshore processes. Although a lake-front harbor with its jetty and breakwater system may be well designed, sediments may accumulate near the outer harbor structures. Since the detrital material is derived directly from the nearshore environment, in most

instances the sediment is composed of sand-size particles. In some instances the sediment is not polluted and can be used for beach nourishment. In harbors on the east coast of Lake Michigan, littoral drift accounts for most of the maintenance dredging volumes which are extracted from these projects. Normally, sand bars will form adjacent to the jetties as the current velocities decrease in these areas.

As indicated in Table 73, the annual quantity of littoral drift generally exceeds the average annual maintenance dredging volume in the harbors. Differences between the littoral transport rate and the maintenance dredging may occur for a number of reasons. For example, at Muskegon Harbor the breakwater is relatively new, therefore sediment is being trapped in the lee of the structure and little material is bypassing the breakwater. Research is required to quantitatively relate the observed alongshore sediment transport to the theoretical energy conditions offshore. However, on exposed coasts where lake front harbors are located, the volume of sediments accumulating in the outer harbors is probably a function of the magnitude and direction of littoral drift.

A significant source of dredged material is industrial and municipal wastes discharged and settling in navigable waterways. Table 74 represents total and suspended solids from selected harbors in Lake Erie and Lake Ontario. Some of the suspended solids are adsorbed onto the suspended load in the rivers and are then deposited as fluvial sediments which must eventually be dredged. At Cleveland, during dredging operations in 1966 and 1967, 660,000 tons of dry solids were removed which included 17,600 tons of oil and grease (24). The suspended sediment load of the Cuyahoga River south of Cleveland is about 200,000 tons annually, however annual maintenance dredging volumes therein exceed 800,000 CY. Materials such as flue dust and fly ash can contribute significantly to the dredging volumes in highly industrialized harbors. At Thunder Bay, Ontario, it has been estimated that 85 percent of the

Table 73. COMPARISON OF LITTORAL DRIFT AND MAINTENANCE DREDGING (50)
(cubic yards)

| Public harbor | Annual quantity of littoral drift volume | Average annual maintenance dredging (mean 1963-1972) |
|---|---|---|
| 1. Grand Haven | 63,000-70,000 | 127,553 |
| 2. Frankfurt | 60,000 | 23,114 |
| 3. Grand Marais, MI | 60,000 | -- |
| 4. Hammond Bay | 7,500 | -- |
| 5. Harbor Beach Lake Huron | 60,000 | 22,825 |
| 6. Harrisville | 10,000 | 600 |
| 7. Holland | 100,000 | 80,000 |
| 8. Leland | 20,000-40,000 | 4,448 |
| 9. Ludington | 81,500 | 26,549 |
| 10. Manistee | 75,000 | 32,390 |
| 11. Muskegon | 100,000 | 45,689 |
| 12. Pentwater | 90,000 | 43,085 |
| 13. Port Sanilac | 40,000-50,000 | 7,670 |
| 14. South Haven | 45,000-50,000 | 42,438 |
| 15. St. Joseph | 110,000 | 57,409 |
| 16. White Lake | 48,000 | 23,482 |
| Totals | approximately 1,072,500 | 547,252 |

Table 74. TOTAL AND SUSPENDED SOLIDS IN SELECTED PROJECTS (24, 55)
(tons)

| Project | Total solids | Suspended solids | Annual maintenance dredging (CY) | Conversion 1 CY=0.675 tons |
|---|---|---|---|---|
| Detroit River | 30,600,000 | 1,600,000 | 800,000 | 540,000 |
| Rouge River | 3,560 | 433 | 300,000 | 202,500 |
| Monroe | 95,700 | 4,700 | 200,000 | 135,000 |
| Toledo | 3,400,000 | 2,000,000 | 1,250,000 | 135,000 |
| Port Clinton | 114,400 | 27,400 | 10,000 | 6,750 |
| Sandusky | 600,000 | 150,000 | 600,000 | 405,000 |
| Lorain | 81,000 | 15,000 | 300,000 | 202,500 |
| Cleveland | 509,000 | 89,000 | 1,220,000 | 823,000 |
| Fairport | -- | -- | 400,000 | 270,000 |
| Buffalo/Tonawanda | -- | -- | 600,000 | 405,000 |
| Buffalo River | 434,000 | 74,000 | as above | -- |
| Vermilion | 90,000 | 17,000 | 500 | 338 |
| Rochester | 1,050,000 | 318,000 | 360,000 | 243,000 |
| Oswego | 3,540,000 | 334,000 | 80,000 | 54,000 |

material dredged from the Kam River and its turning basin is fine wood pulp from local paper plants. At Calumet Harbor perhaps as much as 90 percent of the spoil is due to industrial sedimentation. Dredging rates in the lower Rouge River are far greater than estimated erosion and delivery rates would indicate (32). A more detailed study at Buffalo illustrated that 13 percent of the 1967 dredging activity represented solids such as oil and grease (33). A small decrease in permit dredging, as in Calumet and Indiana Harbors, may result from a reduction of industrial sedimentation by large private industries such as Youngstown Sheet and Tube and Inland Steel Company.

In addition, a considerable amount of dredging in many harbor projects is the result of slumping or sloughing which occurs naturally or due to propeller wash (wheeling) of a vessel. This is particularly evident at bends or meanders of rivers. Another locally significant source of sediments in dredged channels is ice shoving or rafting associated with storms or onshore winds particularly on the south shore of Lake Superior. Drifting of sand by wind waves on exposed Lake Michigan beaches into jetty systems is, in part, responsible for the occurrence of sand bars inside the jetty systems. Also, as a vessel increases speed, the stern settles deeper in the water (squatting) which increases turbulence and sediment transport in the navigation channels. This acceleration of sedimentation due to vessel traffic is noteworthy in waterways such as Lake St. Clair. Thus, the dredging frequency of a given harbor may be controlled by natural and man-induced sedimentation. The sources of sediments are numerous, and are not solely limited to natural river and marine deposition.

## Areas of Sedimentation Within a Harbor

Although each harbor is unique and the areas of sediment deposition vary, some generalizations may be made. Most large, commercial harbors on the

Great Lakes may be subdivided into two sections. The outer harbor extends from the shoreline lakeward and is protected by breakwaters. Landward of the shoreline is the inner portion of the harbor which may extend several miles upriver. Racine Harbor is an example of such a river-mouth and lake-front harbor. Here, the outer harbor is enclosed by a permanent breakwater extending from the shoreline into Lake Michigan. The outer harbor is maintained at project depth of 21 to 23 feet. The inner harbor extends from the shoreline upriver for approximately 1.5 miles, and has a project depth of 19 feet.

Before and after a project is dredged by the C.E., soundings are made and corrected to the low water datum. By comparing pre-dredging and post-dredging sounding charts, the areas of submarine deposition and erosion may be determined. Figure 19 is such a contour map illustrating areas of sediment accumulation and deposition in Racine Harbor. It is based on soundings made in June, 1968, immediately after the harbor was dredged, and in April, 1973. During this interval the harbor was not dredged, thus the contours represent changes in sediment distribution and sediment accumulation over a five-year period.

Figure 20 are cross sections taken along selected traverses in Racine Harbor. Although some erosion has occurred in the outer harbor, the prevalence of sedimentation is clearly evident. Most of the sedimentation occurs in upper and lower ends of the project. Upriver, cross sections A and B reveal that 2 to 3 feet of detritus has accumulated in 5 years. The principal sources of these deposits are erosion from the drainage basin and municipal wastes. Additional sources of detritus for the dredged channel are erosion and slumping of the channel walls due to wheeling and fluvial transport processes. This is most evident in meanders of the Root River. On the map, east of Cross Section C (Fig. 20) is a tongue of sediment extending downstream. Sedimentation occurs when the river flow joins a large body of water, causing a sudden decrease in the velocity of the river (34, 35).

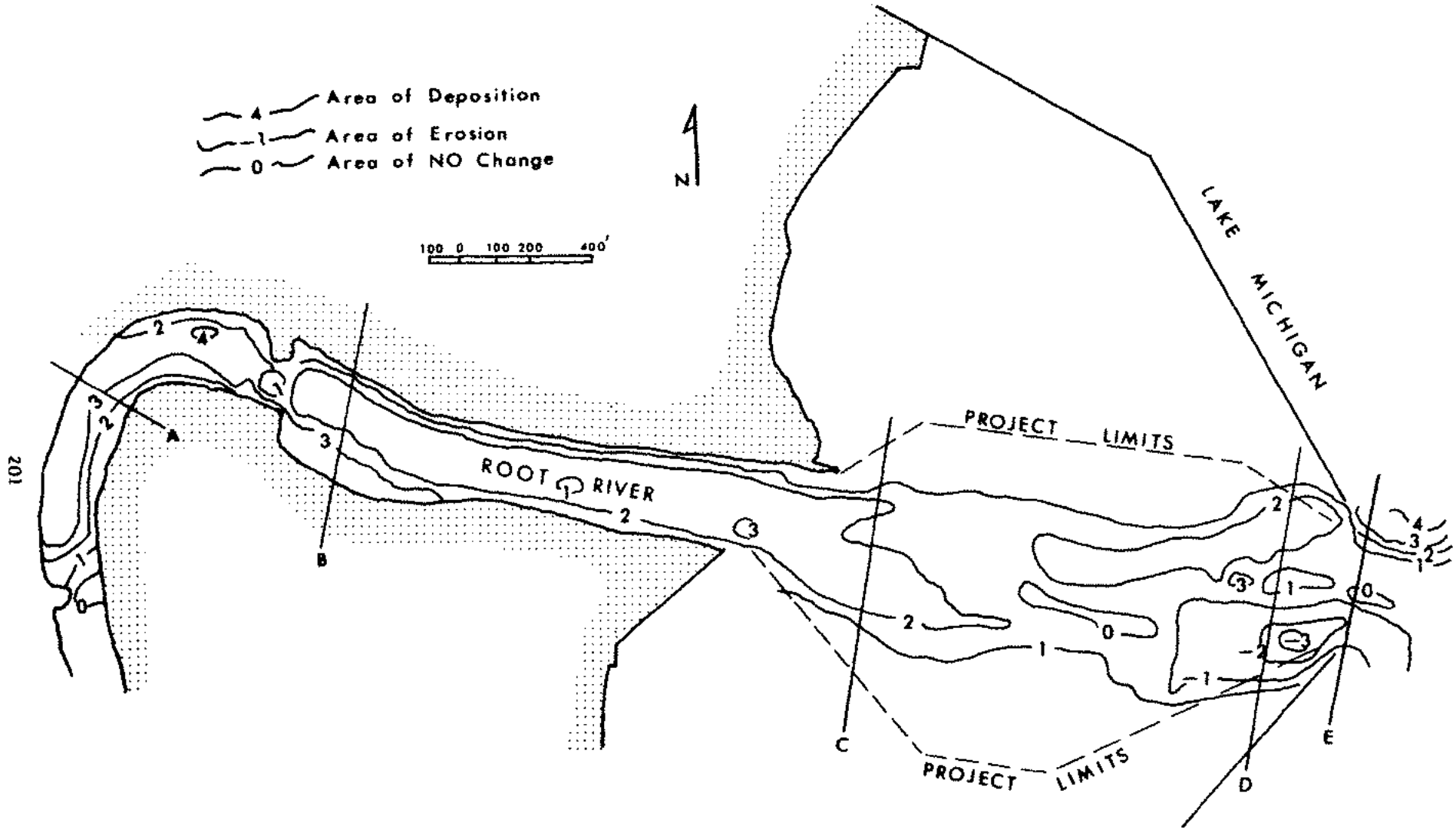



Figure 19. AREAS OF SEDIMENTATION IN RACINE HARBOR, WISCONSIN

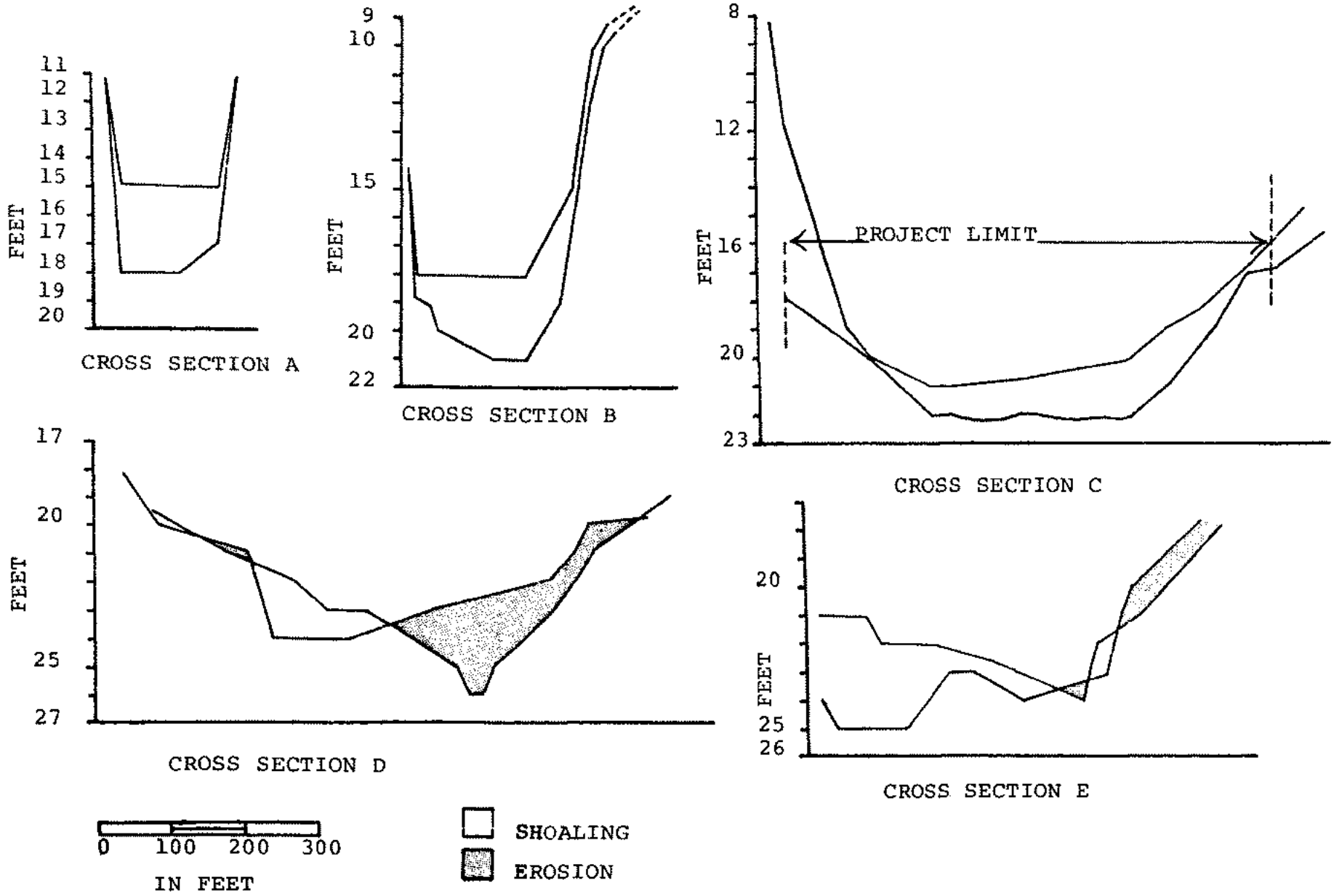



Figure 20. SELECTED CROSS SECTIONS OF THE ROOT RIVER AT RACINE, WISCONSIN

Thus, the principal source of this sediment is the Root River. The contours immediately east of the jetty system indicate the influence of the littoral current causing a southerly migration of the channel. The shift of the channel is clearly evident in cross section D. In this area the sediment source is principally the littoral current flowing from north to south. In such areas sediment accumulation is a constant problem.

Table 75 summarizes the sedimentation in Racine Harbor. As noted by the dredging frequencies, the area which must be constantly maintained is in the vicinity of the jetties. Although low sedimentation in the inner harbor due to stream transport results in considerable dredging quantities, small volumes must frequently be dredged from the approach channels.

Table 75. SEDIMENTATION IN RACINE HARBOR, 1968-1973

| Sediment area | Source of sediment | Accumulation in feet | Dredging frequency, 1958-73 |
|---|---|---|---|
| Upriver | Industrial wastes<br>Slumping<br>Geologic erosion | 2 to 3 | 4 |
| River mouth | River detritus<br>natural and<br>municipal | 2 | 4 |
| Harbor entrance | Littoral zone<br>Some fluvial and<br>municipal | Variable,<br>1 to 4 | 8 |

Summary

In summary, average annual maintenance dredging volumes from river-mouth harbors are not a simple function of sedimentation by streams therein.

Using Racine Harbor, Wisconsin, as an example, it has been demonstrated that there are three main areas of sediment deposition. Sedimentation occurs in the upstream section of the harbor at the head of navigation where sediments transported as river bedload accumulate in the dredged channels. Like a tongue extending downstream toward the lake front, sediments are also deposited throughout the inner harbor, including the turning basin. Because deposition is most conspicuous on the outside of meander bends in the river, the source of these sediments is probably from suspended river load. Finally, the third area of sedimentation is in the outer harbor and approach channels where littoral drift results in continual sediment bypassing of the breakwater and/or jetty system. As the entire harbor is polluted, industrial and municipal sedimentation probably occurs throughout the project.

In many of the commercial public harbors of the Great Lakes, particularly where there are industrial-urban complexes adjacent to the harbor, man-induced sedimentation by industrial and municipal wastes may significantly increase maintenance dredging. Although the sediments in the Great Lakes have a certain level of 'background' pollution and some 'natural' pollution is caused by tree leaves and marsh drainage, pollution of inner harbor areas by industrial and municipal discharges appears to be much more important. As along the east coast of Lake Michigan, sediment transport by beach drift and longshore currents cause considerable deposition in the outer harbor areas. Because these sandy sediments are relatively clean, the C.E. has utilized some of this spoil for nourishing eroding beaches at Holland, Muskegon, Michigan City, and Ontonagon. Using the pre-dredging and post-dredging sounding charts, it is possible to document the areas of sedimentation for each harbor. In addition, if sediment abatement programs are to be successfully implemented to reduce the volume of future maintenance dredging, then the various sources of dredged sediments must first be determined. Sediment abatement programs directed toward the reduction of natural stream

sedimentation, industrial-municipal discharges, and interruption of littoral drift by public harbor structures may significantly decrease the maintenance dredging requirements of many harbors.

## LAKE LEVELS AND DREDGING VOLUMES

The historical records of annual dredging in each of the Great Lakes indicate that the total quantity of dredged spoil varies considerably from year to year. In an attempt to explain part of this variation, the effect of lake levels on the historical dredging volumes was investigated. It is hypothesized that an inverse relationship exists between mean annual lake level and the total quantity of maintenance and private spoil dredged annually in each lake. New work or capital dredging quantities were excluded from the analysis. Maintenance dredging depths in C.E. and D.P.W. projects are measured from the low water datum for each lake referred to mean water level at Father Point, Quebec (Table 76). In addition, the C.E. allows 1 to 2 feet of subgrade, whereas in Canada one foot of overage is common.

Table 76. DATUMS FOR THE GREAT LAKES (7)
(feet)

| Lake | Elevation (low water datum) |
|---|---|
| Ontario | 242.8 |
| Erie | 568.6 |
| Huron-Michigan | 576.8 |
| Superior | 600.0 |

To determine whether or not annual maintenance and private dredging quantities are associated with varying lake levels, a correlation analysis,

using the Pearson-Product Moment formula, was tested on the two variables. Except for Lakes Erie and Ontario, the data covered the period 1940 to 1970. Lake level stations included Oswego, Cleveland, Harbor Beach, Calumet, and Marquette. Lake level data are by calendar year, whereas dredging data is reported by fiscal year. The C.E. fiscal year begins July 1st, while the Canadian fiscal year begins April 1st. This factor must be entered into any correlation analysis. Dredging may be started in April or July and be completed and reported in May or June of the following calendar year.

In Table 77, the simple correlation coefficients are presented by lake. For each lake, the analysis yields an inverse relationship between annual maintenance and private dredging volumes with mean annual lake level. The correlation coefficient exceeds -0.5 only in Lakes Huron and Michigan, indicating a strong relationship where the amplitude of lake level fluctuation is high. When the dredging volumes are lagged one year behind lake levels, then the correlations are slightly strengthened, as compared to direct annual correlation. This reflects the fiscal year

Table 77. CORRELATION BETWEEN LAKE LEVELS AND MAINTENANCE/PRIVATE DREDGING VOLUMES, 1940-1970, IN THE GREAT LAKES

| Lake | Correlation coefficients | | Maximum range of lake level |
|---|---|---|---|
| | Direct annual correlation | One-year lag | |
| Erie[a] | -0.1070 | -0.3659 | 1.97 feet |
| Superior | -0.1134 | -0.2569 | 0.90 |
| Ontario[a] | -0.3208 | -0.3329 | 3.52 |
| Huron | -0.5192 | -0.6265 | 3.85 |
| Michigan | -0.5845 | -0.6400 | 3.88 |

[a]Dredging volume data only 1951-1970.

data lag and the delay between the time of scheduling and funding of a project and the actual completion of the dredging. Using the one-year lag, the improvement in correlation is most apparent in Lake Erie. In Lake Erie, priority appears to be given to maintenance dredging of the large commercial harbors during periods of low lake levels.

During periods of low lake levels, as in the middle 1960's, groundings are more frequent, especially in the spring. In response to complaints of groundings, the C.E. and the D.P.W. strictly maintain all commercial public harbors at their project depths including subgrade. At such times the C.E. usually engages more contract dredgers to insure that the harbors and waterways are free of impassable shoals. Conversely, when lake levels are above normal, as during the early 1970's, maintenance dredging operations may be postponed temporarily. For example, Chicago Harbor and River were last dredged in fiscal year 1967. Since then some shoaling has occurred, but the higher than average lake level has provided sufficient draft for most vessel traffic.

An analysis of the Great Lakes hydrographs reveals that lake levels oscillate (36). Long term oscillations are recognized by the C.E. and G.L.B.C. (37, 7), but cannot be forecasted with sufficient accuracy to assist with dredge planning. The C.E. and the D.P.W. program their operations on the basis of periodic sounding surveillance of all project harbors.

Basically, the variations in lake levels can be classified as follows (37):

1. Long term periodic cycles.
2. Seasonal fluctuations.
3. Short term oscillations.

As demonstrated by Liu (38), a persistent oscillation for all the lakes is an 8 year cycle. Climatic variations appear to control these long term periodic cycles (8). The effect is regional, in that the lakes appear to oscillate in phase. This long term oscillation influences

maintenance dredging when extreme lake levels are reached. Seasonal precipitation produces high lake levels in the summer and low lake levels in winter and early spring as a result of the Great Lakes water budget (39). The small range of seasonal fluctuations in lake levels and occasional vessel groundings in the spring do not significantly effect dredge planning. Short term oscillations, due to local storms, seiches, ice jams and prevailing winds bear no relationship to dredge volumes. These factors primarily influence local sailing schedules, docking and undocking, and piloting functions.

Future long term lake level changes are not applied, in this study, in establishing predictions of future average annual maintenance and private dredging volumes. At the present, the C.E. and the U.S. Lake Survey, using water balance equations, predict lake levels for only 6 months in advance. Nevertheless, a general relationship between future long term lake cycles and future maintenance dredging can be suggested. If lake levels oscillate on an 8-year cycle, and a peak in the present high lake level period is attained in 1974, then low levels can be anticipated in 1978-1979. This low water period may result in somewhat higher than average dredging volumes in 1979 - 1980, applying the lag factors. Prior to that time, maintenance and private dredging volumes may be below the projection of this report. In some polluted harbors, maintenance dredging may be postponed until confined disposal sites or other acceptable means of disposal are developed.

## ECONOMIC FACTORS AND FUTURE DREDGING VOLUMES

The purpose of this subsection is to discuss some general economic aspects in relation to dredging volumes in the next decade. Particularly important in this regard are: (1) factors which may increase or decrease future dredging quantities; and (2) rapidly increasing dredging costs, especially costs of dredging operations and confinement of polluted spoil.

Historical dredging data presented in this report reveal that maintenance and private dredging volumes are slightly increasing, while the new work dredging quantity varies greatly over the years (Table 78). The increase in maintenance and private dredging, including the projected figure, is probably due to widening and deepening of navigation channels to accommodate vessels with deeper drafts. During the 1960's the major commercial harbors, connecting channels, and turning basins were widened and deepened to meet the 27-foot maximum draft requirement of the St. Lawrence Seaway. Although new work dredging may cause some increase in maintenance dredging, the new work associated with the Seaway system was not accompanied by a sharp rise in maintenance dredging. This is because most of the new work dredging involved deepening of existing harbors and connecting channels as well as the construction of locks. Apparently, then, the rate of shoaling in the artificial channels due to sedimentation is relatively constant and is not dramatically affected by increased depths.

Table 78. DREDGING TRENDS IN THE GREAT LAKES, 1951-1983
(millions cubic yards)

| Period | Average annual maintenance and private dredging | Average annual new work dredging | Total |
|---|---|---|---|
| 1951-1960 | 9.17 | 1.79 | 10.96 |
| 1961-1970 | 10.82 | 9.74 | 20.56 |
| 1973-1983 | 11.45 | 4.11 | 15.56 |

The decrease in the number of new work projects scheduled through 1979 suggests that a temporary economic plateau may have been reached in the Great Lakes. Moreover, most of the scheduled new work is designed to accommodate the boating public as several new recreational harbors with 12 to 14 foot drafts are anticipated. Conversely, a projected increase

in bulk traffic from 188 million tons in 1973 to 276 million tons by 1995 (40) should create some demand for new harbor facilities, i.e., docks, slips and berthing areas. In addition, in 1973 the first southbound movements of coal from the Rocky Mountain region occurred in the Great Lakes. A few declining harbors such as Michigan City may actually be revitalized by new coal imports or by increased activity in bulk and general cargo movements. However, these new developments are not yet reflected in the future new work projects.

To handle the increase in bulk shipments of iron ore, limestone, coal, and to some extent, grain, Great Lakes vessels of longer length, greater beam and increased draft are being constructed (41). Since 1970, two 1,000-foot bulk carriers with beams exceeding 100 feet have appeared on the Great Lakes. Several more of these large vessels are in the planning stage. Even though they cannot be loaded to full capacity due to the 27-foot draft limit of the Seaway, these vessels transport about twice the cargo of conventional lake carriers. Many older ships have also been lengthened to the 800-foot category. To achieve economies of scale, the trend in the United States toward larger carriers will probably continue during the next decade, resulting in record bulk cargo volumes but fewer ship transits.

With regard to the effect on future maintenance dredging, the longer vessels with broader beams may cause increased turbulence and sloughing in approach channels, as in Green Bay and Saginaw Harbors. Bow thrusters will permit the vessels to turn essentially in their own length, thus turning basins will not have to be enlarged. However, to avoid grounding of such large carriers, especially due to squatting, connecting and approach channels will have to be dredged to maximum project depth plus subgrade at all times. Therefore, as more of these large carriers are deployed, maintenance dredging requirements in the connecting channels and major commercial harbors may slightly increase, especially during low-water periods.

An increase in the draft of the Seaway system may be limited by cost constraints. As estimated by the U.S. Department of Transport in 1968, the cost of converting and deepening the entire seaway system to a 31-foot capacity was estimated to be 3.5 billion dollars (41). Nearly one-half of this cost involves the deepening of the Welland Canal, which currently has a draft of 27 feet plus subgrade. In the upper Great Lakes, the Poe Lock at Sault Ste. Marie has sills at 32 feet, and it can accommodate vessels of 110 foot beam. To extend the draft of the upper Great Lakes to 32 feet, St. Marys Channel, St. Clair River, and Detroit River would have to be dredged to 32 feet. To date, deepening of these connecting channels has not been justified.

The economic feasibility of an extended navigation season is currently being investigated (42). To many shippers, particularly in the U.S., an extended season is vital to the future vitality of the Great Lakes navigation system. Although an extension seems likely in the near future, no significant effect on future maintenance and new work dredging is anticipated.

Several economic factors may cause a levelling off of future maintenance and new work dredging volumes. First, a few small, commercial harbors which are no longer economically justified (such as Saugatuck and Pentwater) may be downgraded to recreational status and maintained at 12 to 14 foot depths. In Canada, a number of small semi-commercial harbors have been reclassified and transferred. Projects such as Grand Bend, Killarney and Blind River have been transferred from the M.O.T. to the Fisheries and Marine Section of the M.O.E.

Other factors which may depress future maintenance dredging volumes include rising dredging costs, competition from other modes of transport, and sediment abatement programs. In Canada, all maintenance dredging is contracted to public tenders. As has been pointed out in the Policy Section, government-owned dredging plants can reduce the cost of

maintenance dredging operations by about 50 percent. In addition, the C.E. has estimated that the transport and disposal of polluted maintenance dredgings in confined disposal sites could increase dredging costs 350 percent (1). Rising costs of dredging will probably result in dredging priorities, perhaps by comparing cost-benefit ratios of the harbors to be dredged. In Canada, the M.O.T. has recently assumed the administration of the public harbors from the D.P.W., thus reflecting some economic concern over navigation and dredging.

Competition from other carriers for non-bulk commodities traditionally moved by lake carriers may result in less dredging in the future. Improvements in land transportation such as unit trains or pipelines may cause lower demand for shipping on the Great Lakes. In fact, cost feasibility of transporting taconite from the Lake Superior area to Chicago by pipeline has been established (43). In addition, Canadian railroads have been competing successfully for containerized freight which customarily moved by ship along the Seaway route from Halifax to Detroit (44). Conversely, if the energy crisis in the U.S. worsens, hampering future rail and truck traffic, then shipping volumes on the lakes may increase since water transport is significantly more energy efficient. Studies by the St. Lawrence Seaway Development Corporation conclude that 15 to 20 million gallons of fuel could be saved each year if 50 percent of the import-export cargoes originating in or destined for states bordering the Great Lakes were moved on the Seaway rather than overland to ports on the East Coast (45).

If implemented, sediment abatement programs could significantly reduce shoaling and hence reduce dredging. It has been estimated that the stream load of the Maumee River could be significantly reduced of sediment traps on the upper river were installed (1). Along the eastern shore of Lake Michigan, where littoral drift results in shoaling near the breakwater and jetty systems, some reduction in sediment bypassing may be feasible. New policies in the U.S. and Canada regarding the

effect of federal harbor structures on littoral transport of beach sediments could promote the development of abatement programs along exposed coasts.

Perhaps the most important economic factor which may influence future dredging volumes is the high cost of the confined disposal program for polluted spoil. Costs of dredging and disposing spoil in diked sites, including construction costs, are approximately $10 per cubic yard, while disposal in the open waters of the Great Lakes averages about $1.00 per cubic yard. Even though larger sites are generally less expensive to construct and maintain, the confined disposal program of the C.E., involving 35 polluted harbors, may require an expenditure of $85 million (1). Should construction of confined disposal sites be delayed, maintenance dredging of some polluted harbors may have to be postponed. At present the construction of the diked site for Cleveland Harbor is 6 months behind schedule, and although lake levels are at a record high, groundings have been reported.

Though the cost of confining polluted dredged spoil is high, the total cost may be lower than some preliminary projections. In this report the future average annual quantity of polluted spoil in the Great Lakes has been estimated to be about 7.5 million CY place measure. In their 1969 report, the C.E. projected that the future average annual quantity of polluted spoil from only 35 harbors in the U.S. will be 8,573,000 CY (1). Our projection of future polluted spoil includes private and maintenance dredging of all polluted and partially polluted harbor sediments in the U.S. and Canada, whereas the C.E. projection includes only polluted maintenance dredgings to be derived from 35 American harbors and waterways. The projection of the C.E. appears high because some of the volumes were not converted to place measure and, in partially polluted harbors (P/U), the polluted portion was not separated from the unpolluted portion. The new pollution guidelines, to be promulgated by the E.P.A. in 1975, may result in the reclassification of some of the

small harbors which are currently considered partially polluted. In addition, the confined disposal sites may actually contain as much as 25 percent more spoil than anticipated. For example, at Buffalo Harbor, the diked site was designed for a capacity of 400,000 cubic yards, but more than 500,000 cubic yards were disposed there.

In summary, economic factors regarding future planning of new work projects and scheduling of maintenance dredging will probably be given more consideration. In Canada, this change is evidenced by the assumption of harbor administration by the M.O.T. Rising costs of dredging and disposal of spoil may result in the necessity for the establishment of dredging priorities based on cost-benefit comparisons. Such priorities based on cost-benefit ratios and the trend toward larger vessels with economy of scales will probably promote the decline of the small, commercial harbors. Maintenance dredging may actually increase slightly in connecting channels and major industrial harbors. The projected increase in bulk commodity movements and the pressure for an extended navigation season should offset the competition for containerized freight and general cargo by other modes of transport. However, future maintenance and new work dredging volumes are not expected to be affected by these developments. With the rising cost of dredging and the high capital costs of confined disposal sites for polluted spoil, dredging and disposal site priorities are foreseeable. The C.E. anticipated the need for priorities by designing diked disposal sites first for the large, commercial harbors which are unequivocally justified and heavily polluted.

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## SECTION VIII

## LIST OF ABBREVIATIONS

| | |
|---|---|
| BNA Act | British North America Act |
| C.E. | United States Army Corps of Engineers |
| COD | Chemical Oxygen Demand |
| CY | cubic yards |
| D.P.W. | Department of Public Works of Canada |
| E.P.A. | United States Environmental Protection Agency |
| F.Y. | fiscal year |
| G.L.B.C. | Great Lakes Basin Commission |
| M.O.E. | Ministry of the Environment of Ontario |
| M.O.T. | Ministry of Transport of Canada |
| NEPA | National Environmental Policy Act of the United States |
| N.O.A.A. | National Oceanic and Atmospheric Administration |
| NWPA | Navigable Waters Protection Act of Canada |
| P.W.C. | Public Works Commission of Canada (now D.P.W.) |
| S.L.S.A. | St. Lawrence Seaway Authority |

## TECHNICAL REPORT DATA

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| 1. REPORT NO. | 2. | 3. RECIPIENT'S ACCESSION NO. |
|---|---|---|
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| 7. AUTHOR(S)<br>C. N. Raphael, E. Jaworski, C.F. Ojala and D.S. Turner | | 8. PERFORMING ORGANIZATION REPORT NO. |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS<br>Department of Geography and Geology<br>Eastern Michigan University<br>Ypsilanti, Michigan 48197 | | 10. PROGRAM ELEMENT NO.<br>11. CONTRACT/GRANT NO.<br>R-801062 |
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15. SUPPLEMENTARY NOTES

16. ABSTRACT

Based on historical records, an overview and projection of U.S. and Canadian dredging quantities in the Great Lakes are presented. Using current pollution criteria, future quantities of polluted maintenance dredging are estimated for each lake. Recent environmental policies have influenced dredging and particularly disposal practices. These policies, as well as sedimentation, lake levels, and economic factors are discussed in relation to dredging.

During the next decade, maintenance and private dredging volumes will not change significantly, whereas new work will decrease. As in the past, most maintenance dredging will occur in U.S. projects, particularly in Lake Erie.

A factor which will determine future U.S. maintenance dredging is the availability of confined disposal sites. If the 62 sites are completed for commercial harbors as planned, 300,000 of the 6.45 million cubic yards of annual projected polluted spoil will not have disposal facilities. Where pollution elimination systems are in use, shoaling in some industrial harbors may be decreasing. Although long-term lake levels are not predictable, an inverse relationship between maintenance dredging and lake levels is evident.

17. KEY WORDS AND DOCUMENT ANALYSIS

| a. DESCRIPTORS | b. IDENTIFIERS/OPEN ENDED TERMS | c. COSATI Field/Group |
|---|---|---|
| Great Lakes<br>Dredging volumes<br>Disposal<br>Lake Levels<br>Policy<br>Sedimentation<br>Disposal Sites<br>Navigation | | |

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**From:** Leclerc, Erika (MCM)
**To:** Jean-Louis Gaudet
**Cc:** Stephen Ho; Barboza, Karla (She/Her) (MCM); EA Notices to NRegion (MECP); Mike Cornell; sshinde@municipalityofkillarney.ca; Candy Beauvais
**Subject:** RE: MCM Response - Municipality of Killarney: Municipal Class EA for the Killarney Municipal Wharf Improvements - Notice of Completion
**Date:** Monday, July 15, 2024 1:11:54 PM
**Attachments:** image002.png
image004.jpg
image005.png

Hello Jean-Louis,

Thank for sending the response to our comments. We will review the PDF and follow up if we have any additional comments.

Best regards,

**Erika Leclerc**
Heritage Planner | Heritage Branch | Citizenship, Inclusion and Heritage Division
Ministry of Citizenship and Multiculturalism | Ontario Public Service
416-305-0757 | erika.leclerc@ontario.ca

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---

**From:** Jean-Louis Gaudet <jeanlouis.gaudet@exp.com>
**Sent:** Wednesday, July 10, 2024 12:22 PM
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**Cc:** Stephen Ho <steve.ho@exp.com>; Barboza, Karla (She/Her) (MCM) <Karla.Barboza@ontario.ca>; EA Notices to NRegion (MECP) <eanotification.nregion@ontario.ca>; Mike Cornell <Michael.Cornell@exp.com>; sshinde@municipalityofkillarney.ca; Candy Beauvais <cbeauvais@municipalityofkillarney.ca>
**Subject:** RE: MCM Response - Municipality of Killarney: Municipal Class EA for the Killarney Municipal Wharf Improvements - Notice of Completion

**CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.**

Hi Erika,

We are just following up on your comments from February 9, 2024 on the Killarney Municipal Wharf Improvements ESR.

Please find EXP's responses attached.

Thank you for your inputs, and we hope this clarifies any questions the Ministry may have.

Regards,

Jean-Louis

**Jean-Louis Gaudet, B.Sc.**
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**From:** Leclerc, Erika (MCM) <erika.leclerc@ontario.ca>
**Sent:** Friday, February 9, 2024 10:54 AM
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**Subject:** MCM Response - Municipality of Killarney: Municipal Class EA for the Killarney Municipal Wharf Improvements - Notice of Completion

Some people who received this message don't often get email from erika.leclerc@ontario.ca. Learn why this is important

Dear Jean-Louis Gaudet,

Thank you for sending the Notice of Study Completion for the above-mentioned project to the Ministry of Citizenship and Multiculturalism (MCM). Please find attached MCM's comments on this project.

Please do not hesitate to contact us if you have any questions.

Kind regards,

**Erika Leclerc** (she/her)
Heritage Planner
Ministry of Citizenship and Multiculturalism

(416) 305-0757 | erika.leclerc@ontario.ca

---

**From:** Jean-Louis Gaudet <jeanlouis.gaudet@exp.com>
**Sent:** January 11, 2024 8:40 PM
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**Cc:** kchampaigne <kchampaigne@municipalityofkillarney.ca>; Stephen Ho <steve.ho@exp.com>
**Subject:** Municipality of Killarney: Municipal Class EA for the Killarney Municipal Wharf Improvements - Notice of Completion

**CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.**

Good afternoon,

The Municipality of Killarney has completed a Schedule C Municipal Class Environmental Assessment (Class EA) study for improvements to the municipal wharf located at 21 Channel Street South in the Village of Killarney.

Please find attached the project's Notice of Completion.

An Environmental Study Report (ESR) has been prepared for the project and is being made available for public review. Subject to comments received following this Notice and the receipt of approvals, the Municipality intends to proceed with implementation of the recommended project as outlined in the ESR (funding dependent).

The ESR may be downloaded from the project website: http://municipalityofkillarney.ca/municipal-wharf/.

Interested persons may provide written comments to our project team by February 12, 2024. Please see the attached notice for contact information.

Regards,

Jean-Louis Gaudet



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## Jean-Louis Gaudet

**From:** Leclerc, Erika (MCM) <erika.leclerc@ontario.ca>
**Sent:** Thursday, August 1, 2024 2:18 PM
**To:** Jean-Louis Gaudet
**Cc:** Stephen Ho; Barboza, Karla (She/Her) (MCM); EA Notices to NRegion (MECP); Mike Cornell; sshinde@municipalityofkillarney.ca; Candy Beauvais
**Subject:** RE: MCM Response - Municipality of Killarney: Municipal Class EA for the Killarney Municipal Wharf Improvements - Notice of Completion
**Attachments:** 2024-08-01 KillarneyWharf_ESR_MCMResponse_Draft.pdf

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**CAUTION**: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Good afternoon Jean-Louis,

Thanks again for providing the response to our comments. Please find attached MCM's response.

Please do not hesitate to contact me if you have any questions.

Best regards,

**Erika Leclerc**
Heritage Planner | Heritage Branch | Citizenship, Inclusion and Heritage Division
Ministry of Citizenship and Multiculturalism | Ontario Public Service
416-305-0757 | erika.leclerc@ontario.ca

Ontario

*Taking pride in strengthening Ontario, its places and its people*

---

**From:** Leclerc, Erika (MCM)
**Sent:** Monday, July 15, 2024 1:12 PM
**To:** Jean-Louis Gaudet <jeanlouis.gaudet@exp.com>
**Cc:** Stephen Ho <steve.ho@exp.com>; Barboza, Karla (She/Her) (MCM) <Karla.Barboza@ontario.ca>; EA Notices to NRegion (MECP) <eanotification.nregion@ontario.ca>; Mike Cornell <Michael.Cornell@exp.com>; sshinde@municipalityofkillarney.ca; Candy Beauvais <cbeauvais@municipalityofkillarney.ca>
**Subject:** RE: MCM Response - Municipality of Killarney: Municipal Class EA for the Killarney Municipal Wharf Improvements - Notice of Completion

Hello Jean-Louis,

Thank for sending the response to our comments. We will review the PDF and follow up if we have any additional comments.

Best regards,

**Erika Leclerc**
Heritage Planner | Heritage Branch | Citizenship, Inclusion and Heritage Division
Ministry of Citizenship and Multiculturalism | Ontario Public Service
416-305-0757 | erika.leclerc@ontario.ca

Ontario

*Taking pride in strengthening Ontario, its places and its people*

**From:** Jean-Louis Gaudet <jeanlouis.gaudet@exp.com>
**Sent:** Wednesday, July 10, 2024 12:22 PM
**To:** Leclerc, Erika (MCM) <erika.leclerc@ontario.ca>
**Cc:** Stephen Ho <steve.ho@exp.com>; Barboza, Karla (She/Her) (MCM) <Karla.Barboza@ontario.ca>; EA Notices to NRegion (MECP) <eanotification.nregion@ontario.ca>; Mike Cornell <Michael.Cornell@exp.com>; sshinde@municipalityofkillarney.ca; Candy Beauvais <cbeauvais@municipalityofkillarney.ca>
**Subject:** RE: MCM Response - Municipality of Killarney: Municipal Class EA for the Killarney Municipal Wharf Improvements - Notice of Completion

**CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.**

Hi Erika,

We are just following up on your comments from February 9, 2024 on the Killarney Municipal Wharf Improvements ESR.

Please find EXP's responses attached.

Thank you for your inputs, and we hope this clarifies any questions the Ministry may have.

Regards,

Jean-Louis

**Jean-Louis Gaudet, B.Sc.**
EXP | Project Coordinator
t : +1.905.525.6069, 65031 | m : +1.416.728.6261 | e : jeanlouis.gaudet@exp.com
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**From:** Leclerc, Erika (MCM) <erika.leclerc@ontario.ca>
**Sent:** Friday, February 9, 2024 10:54 AM
**To:** Jean-Louis Gaudet <jeanlouis.gaudet@exp.com>
**Cc:** kchampaigne <kchampaigne@municipalityofkillarney.ca>; Stephen Ho <steve.ho@exp.com>; Barboza, Karla (She/Her) (MCM) <Karla.Barboza@ontario.ca>; EA Notices to NRegion (MECP) <eanotification.nregion@ontario.ca>
**Subject:** MCM Response - Municipality of Killarney: Municipal Class EA for the Killarney Municipal Wharf Improvements - Notice of Completion

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**Ministry of Citizenship and Multiculturalism**

Heritage Planning Unit
Heritage Branch
Citizenship, Inclusion and Heritage Division
5th Flr, 400 University Ave
Tel.: 416-305-0757

**Ministère des Affaires civiques et du Multiculturalisme**

Unité de la planification relative au patrimoine
Direction du patrimoine
Division des affaires civiques, de l'inclusion et du patrimoine
Tél.: 416-305-0757

August 1, 2024 Email Only

Jean-Louis Gaudet, B.Sc.
Project Coordinator
EXP Services Inc.
1266 South Service Road, Unit C1-1
Stoney Creek, ON L8E 5R9
jeanlouis.gaudet@exp.com

| | | |
|---|---|---|
| **MCM File** | **:** | **0018005** |
| **Proponent** | **:** | **Municipality of Killarney** |
| **Subject** | **:** | **Municipal Class Environmental Assessment – Schedule C** |
| **Project** | **:** | **Killarney Municipal Wharf Improvements** |
| **Location** | **:** | **Municipality of Killarney** |

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Dear Jean-Louis Gaudet:

Thank you for your response to the Ministry of Citizenship and Multiculturalism (MCM)'s comments (dated February 9, 2024) on the Environmental Study Report (ESR, dated January 9, 2024, and prepared by EXP Services Inc.) for the above-referenced project.

MCM's interest in this Environmental Assessment (EA) project relates to its mandate of conserving Ontario's cultural heritage.

**Project Summary**
The Municipality of Killarney has completed a Municipal Class EA (MCEA) study for improvements to the municipal wharf located at 21 Channel Street South in the Village of Killarney. This study was undertaken to address the wharf's deteriorating condition and to improve its resilience to elevated lake water levels. The study was conducted as a "Schedule C" project under the MCEA (March 2023).

**Comments**
We have reviewed the letter from EXP (dated July 10, 2024) and have the following overall comments and observations to help support fulfilment of the requirements of the MCEA process:

*Archaeological Resources*
As indicated in MCM's February 2024 comments, please note that archaeological concerns have not been fully addressed until reports have been entered into the Ontario Public Register of Archaeological Reports where those reports recommend that:

1. the archaeological assessment (AA) of the project area is complete and
2. all archaeological sites identified by the assessment are either of no further cultural heritage value or interest (as per Section 48(3) of the *Ontario Heritage Act*) or that mitigation of impacts has been accomplished through excavation or an avoidance and protection strategy.

The summary of the AA report (under Project Information Form (PIF) number P094-0330-2022) included in Section 8.5.1 of the ESR is preliminary until the above-described conditions have been met. Please note that the report is awaiting MCM's review. MCM continues to recommend that the ESR indicate the status and PIF number of the AA report. Alternatively, this could also be documented in an erratum. We also recommend that the licensed archaeologist who filed the report submit an expedited review request to MCM.

In addition, EXP's (July 2024) response to MCM provided documentation to clarify the conclusion that the project area has low potential for marine archaeological resources, and that a marine AA is not required. The response letter indicates that:

- The study area has been subject to recent, extensive, and intensive disturbance due to past dredging and construction activities.
- Examples include dredging of the Killarney Channel in the 1970s, and construction projects such as infill of the shoreline, and the installation of a watermain.

MCM recommends that the ESR (or erratum) clearly articulate how the proponent arrived at the conclusion that there is low potential for marine archaeological resources. Ideally, supporting documentation should be included in the ESR (as an appendix), otherwise, the information should be summarized.

*Built Heritage Resources and Cultural Heritage Landscapes*

EXP's (July 2024) letter to MCM provided additional information to clarify the conclusion that the project area has low potential for built heritage resources (BHRs) and cultural heritage landscapes (CHLs) and that a Cultural Heritage Evaluation Report (CHER) was therefore not required for the study area. EXP's response letter indicates that:

- Aerial imagery shows that there are no structures on the wharf other than the Herbert Fisheries building and the boathouse.
- The Herbert Fisheries building was constructed in 2013.
- While the boathouse dates to 1951 or earlier, it was not considered as a potential BHR or CHL due to the municipality's intention to demolish it as the boathouse has been deemed unsafe. The boathouse has since been removed.

MCM's *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes* screening checklist (question 4.d.) states that any building or structure 40 or more years old could have potential cultural heritage value or interest. A building or structure can include:

- A residential structure
- A farm building or outbuilding
- An industrial, commercial, or institutional building
- A remnant or ruin
- Engineering work such as a bridge, canal, dams, etc

As noted in our February 2024 letter, considering that the wharf itself (a structure) was constructed in 1951, the answer to question 4.d. should have been "yes." MCM continues to recommend that the proponent clarify with additional supporting documentation why a CHER is not required. If documentation cannot be provided, then a CHER shall be undertaken by a qualified person to support this EA project.

We have attached a detailed table with comments and suggested revisions to ensure the documentation of cultural heritage due diligence and alignment with the legislative framework.

Thank you for consulting MCM on this project. If you have any questions or require clarification, please do not hesitate to contact me.

Sincerely,

Erika Leclerc
Heritage Planner
Heritage Planning Unit
Erika.leclerc@ontario.ca

Copied to: Candy K. Beauvais, Clerk-Treasurer, Municipality of Killarney
Sanket Shinde, Project Coordinator, Municipality of Killarney
Stephen Ho, M.Eng., P.Eng., Consultant Project Manager, EXP Services Inc
Jason Scott, Manager, Sudbury District Office, MECP
Lilly Floerke, Assistant Project Officer, MECP
Karla Barboza, Team Lead Heritage Planning Unit, MCM

It is the sole responsibility of proponents to ensure that any information and documentation submitted as part of their EA report or file is accurate. The Ministry of Citizenship and Multiculturalism (MCM) makes no representation or warranty as to the completeness, accuracy or quality of the any checklists, reports or supporting documentation submitted as part of the EA process, and in no way shall MCM be liable for any harm, damages, costs, expenses, losses, claims or actions that may result if any checklists, reports or supporting documents are discovered to be inaccurate, incomplete, misleading or fraudulent.

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out an archaeological assessment, in compliance with Section 48(1) of the *Ontario Heritage Act*.

The *Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33* requires that any person discovering human remains must cease all activities immediately and notify the police or coroner. If the coroner does not suspect foul play in the disposition of the remains, in accordance with *Ontario Regulation 30/11* the coroner shall notify the Registrar, Ontario Ministry of Public and Business Service Delivery, which administers provisions of that Act related to burial sites. In situations where human remains are associated with archaeological resources, the Ministry of Citizenship and Multiculturalism should also be notified (at archaeology@ontario.ca) to ensure that the archaeological site is not subject to unlicensed alterations which would be a contravention of the *Ontario Heritage Act*.

| Comment # | MCM Comment (Text from Initial Letter) | EXP Response | MCM Response |
|---|---|---|---|
| 1. | A Stage 1 archaeological assessment (AA) was completed for this project (under Project Information Form (PIF) number P094-0330-2022). The report has been submitted to MCM and is awaiting review. MCM recommends that Section 8.5.1 of the ESR specify the PIF number and status of the Stage 1 AA. | Thank you for this clarification. However, to avoid confusion over report version control, EXP recommends against opening the report for this minor edit for the following reasons:<br>• The client is aware of the status of the Stage 1 AA and the report's PIF Number.<br>• Section 15.4 (Permits and Approvals) specifically notes that, at the time of the posting of the ESR for public review:<br>o The Stage 1 AA was to be submitted to MCM;<br>o The report was to be reviewed by MCM to ensure it complies with the standards and guidelines issued by the Ministry and that the archaeological field work and report recommendations ensure the conservation, preservation, and protection of the cultural heritage of Ontario; and<br>o A clearance letter will be issued by the Ministry once it feels all matters relating to archaeological sites within the project area have been addressed to the satisfaction of the Ministry.<br><br>We trust this description adequately conveys the status of the Stage 1 AA at the time the ESR was posted. | Please see our comments in the cover letter. MCM understands concerns about report version control. We recommend that the PIF number and status of the AA be documented in an erratum. |

| | | | |
|---|---|---|---|
| 2. | Please note that archaeological concerns have not been fully addressed until reports have been entered into the Ontario Public Register of Archaeological Reports where those reports recommend that:<br>1. the archaeological assessment of the project area is complete and<br>2. all archaeological sites identified by the assessment are either of no further cultural heritage value or interest (as per Section 48(3) of the *Ontario Heritage Act*) or that mitigation of impacts has been accomplished through excavation or an avoidance and protection strategy. | Understood. | Please see cover letter. |
| 3. | Proponents should wait to receive the MCM's review letter indicating that the report(s) has been entered into the Register before issuing a decision or proceeding with any ground disturbing activities. | Understood. | Acknowledged. |
| 4. | Section 8.5.1 of the ESR indicates that MCM's Criteria for Evaluating Marine Archaeological Potential: A Checklist for Non-Marine Archaeologists was completed for areas of potential in- water impacts. The ESR notes that the checklist determined the area of potential in-water impacts has low marine archaeological potential and therefore no marine assessment is required. A copy of the checklist is provided in Appendix B. No supporting documentation was included with the checklist. The proponent should clarify with supporting documentation how it has concluded that the project area has been subjected to recent, extensive, and intensive disturbance (see question 8 of the checklist). If | The disturbance at and around the wharf has occurred due to past dredging and construction activities.<br><br>For example, the United States Environmental Protection Agency reported in 1974 that the Killarney Channel was a waterway with commercial status, and it was routinely dredged by the Federal Department of Public Works to maintain a 27-foot seaway depth[1].<br><br>Additionally, construction activities have taken place around the wharf periodically in recent decades that would have created disturbances. Examples of these are depicted in Attachment A | Please see cover letter. The ESR should clearly articulate how this conclusion was reached. Ideally, documentation should be included, or a summary of the information can be provided. |

| | | | |
|---|---|---|---|
| | documentation cannot be provided, then a marine AA shall be undertaken. | through various maps and drawings. These examples include infill of the shoreline to create a parking lot at the wharf and installation of a watermain (off the west side of the wharf) to George Island, on the other side of the channel.<br><br>1. United States Environmental Protection Agency. Future Dredging Quantities in the Great Lakes. EPA-660/3-74-029. December 1974. | |
| 5. | Section 8.5.2 of the ESR states that MCM's Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes was completed to assess the study area, and further that there is low potential for built heritage resources and cultural heritage landscapes. A Cultural Heritage Evaluation Report (CHER) was therefore not completed for the study area.<br><br>We note that no supporting documentation was included with the checklist. Section 6.1.1 of the ESR indicates that the wharf was originally built in 1951 and that the wharf underwent significant upgrades in 2013. The answer to question 4.d should therefore have been "yes." MCM recommends that the proponent clarify with supporting documentation why a CHER is not required. If documentation cannot be provided, then a CHER shall be undertaken by a qualified person to support this EA project. | It was intended that the supporting information was included in the text and figures of ESR, and this is discussed here.<br><br>Aerial imagery shows that there are no structures on the wharf other than the Herbert Fisheries building and the boathouse.<br><br>The Herbert Fisheries building was built in 2013. While the boathouse dates to 1951 or earlier, it was not included in this assessment because of the Municipality's intention to demolish it in response to an order from the municipal building inspector, as the boathouse has been deemed unsafe. At the Municipality's June 14, 2023 council meeting, the Municipality passed Resolution 23-228, which stated that "Be it resolved that further to the Order to Comply #23-101 dated May 31, 2023 from the Chief Building Official that the Municipality of Killarney demolish the boathouse structure located at 21 Channel Street as it is a hazard to the health/safety of persons;". The boathouse has since been removed. | Please see cover letter. The wharf itself (constructed in 1951) is over 40 years old and therefore could have potential cultural heritage value or interest. The proponent should provide clarification and documentation as to why a CHER is not required. If documentation cannot be provided, a CHER shall be undertaken by a qualified person. |

| | | | |
|---|---|---|---|
| | | Given the above, it was concluded that there are no buildings or structures on the wharf more 40 years old than would be impacted by the proposed works, and therefore the response to 4d was “no”. | |

**From:** Jean-Louis Gaudet
**To:** Leclerc, Erika (MCM)
**Cc:** Barboza, Karla (She/Her) (MCM); Mike Cornell; sshinde@municipalityofkillarney.ca
**Subject:** RE: Killarney Municipal Wharf Improvements MCEA [MCM File 0018005]
**Date:** Friday, January 10, 2025 11:12:00 AM
**Attachments:** image001.jpg

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Hi Erika,

Happy New Year to you, I hope you and Karla had a nice holiday break.

I wanted to give you an update on the CHER for the Killarney Wharf EA project. ASI has been given the go-ahead to proceed with the CHER, and we are in the stages of getting it going.

Once the draft report has been prepared, I will provide you an update on its findings, timing on the report's submission to MCM, and how the findings might be incorporated into an EA addenda.

Please feel free to reach out to me if you have any questions.

Thanks,

Jean-Louis

**Jean-Louis Gaudet, B.Sc.**
EXP | Project Coordinator
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-----Original Appointment-----

**From:** Leclerc, Erika (MCM)
**Sent:** Friday, November 15, 2024 4:07 PM
**To:** Leclerc, Erika (MCM); Jean-Louis Gaudet; Barboza, Karla (She/Her) (MCM)
**Subject:** Killarney Municipal Wharf Improvements MCEA [MCM File 0018005]
**When:** Tuesday, November 19, 2024 2:30 PM-3:00 PM (UTC-05:00) Eastern Time (US & Canada).
**Where:** Microsoft Teams Meeting

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## Jean-Louis Gaudet

**From:** Leclerc, Erika (MCM) <erika.leclerc@ontario.ca>
**Sent:** Wednesday, January 15, 2025 10:52 AM
**To:** Jean-Louis Gaudet
**Cc:** Barboza, Karla (She/Her) (MCM); Mike Cornell; sshinde@municipalityofkillarney.ca
**Subject:** MCM Response - Killarney Municipal Wharf Improvements MCEA [MCM File 0018005]

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Good morning Jean-Louis,

Happy New Year to you and your team!

Thank you for sending the update on the above-referenced project, it is appreciated.

I also wanted to inform you that the Stage 1 AA (under PIF number P094-0330-2022) is still under MCM review.

Kind regards,

**Erika Leclerc**
Heritage Planner | Heritage Branch | Citizenship, Inclusion and Heritage Division
Ministry of Citizenship and Multiculturalism | Ontario Public Service
416-305-0757 | erika.leclerc@ontario.ca

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---

**From:** Jean-Louis Gaudet
**Sent:** Friday, January 10, 2025 11:12 AM
**To:** Leclerc, Erika (MCM)
**Cc:** Barboza, Karla (She/Her) (MCM) ; Mike Cornell ; sshinde@municipalityofkillarney.ca
**Subject:** RE: Killarney Municipal Wharf Improvements MCEA [MCM File 0018005]

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Hi Erika,

Happy New Year to you, I hope you and Karla had a nice holiday break.

I wanted to give you an update on the CHER for the Killarney Wharf EA project. ASI has been given the go-ahead to proceed with the CHER, and we are in the stages of getting it going.

Once the draft report has been prepared, I will provide you an update on its findings, timing on the report's submission to MCM, and how the findings might be incorporated into an EA addenda.

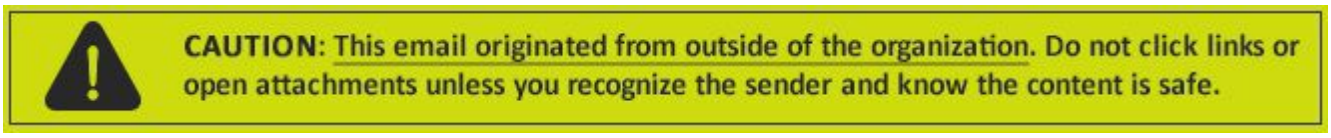
Please feel free to reach out to me if you have any questions.

Thanks,

Jean-Louis

**Jean-Louis Gaudet, B.Sc.**
EXP | Project Coordinator
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-----Original Appointment-----
**From:** Leclerc, Erika (MCM) <erika.leclerc@ontario.ca>
**Sent:** Friday, November 15, 2024 4:07 PM
**To:** Leclerc, Erika (MCM); Jean-Louis Gaudet; Barboza, Karla (She/Her) (MCM)
**Subject:** Killarney Municipal Wharf Improvements MCEA [MCM File 0018005]
**When:** Tuesday, November 19, 2024 2:30 PM-3:00 PM (UTC-05:00) Eastern Time (US & Canada).
**Where:** Microsoft Teams Meeting




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## Jean-Louis Gaudet

**From:** Jean-Louis Gaudet
**Sent:** Sunday, June 15, 2025 11:54 PM
**To:** Leclerc, Erika (MCM)
**Cc:** Barboza, Karla (She/Her) (MCM); Mike Cornell; sshinde@municipalityofkillarney.ca; John Sleath
**Subject:** RE: MCM Response - Killarney Municipal Wharf Improvements MCEA [MCM File 0018005]

Hi Erika,

I hope this e-mail finds you well.

I wanted to give you a status update on the cultural heritage works that were undertaken for the Killarney Municipal Wharf Class EA.

The CHER has been completed, and the report will be forwarded to MCM shortly from either the municipality or our cultural heritage consultant (both are cc'd here).

The report confirms that the wharf has cultural heritage value, based on the following criteria:

- Criterion #4: The property has historical value or associative value because it has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community:
  - The wharf meets this criterion as its locations and various iterations over time has a direct association with the theme of commerce and with the activity of fishing. In particular, the wharf site has been busy from the arrival and settlement of fishermen in the community in the early nineteenth century through to the present.

- Criterion #7: The property has contextual value because it is important in defining, maintaining or supporting the character of an area:
  - The wharf meets this criterion because it supports and makes a significant contribution to the area's commercial identity, transportation services, and waterfront tourism industry.

- Criterion # 8: The property has contextual value because it is physically, functionally, visually or historically linked to its surroundings:
  - The wharf meets this criterion because it is functionally and historically linked to its surroundings. The wharf, much like the buildings and lots in its vicinity, have historically been associated with water-based transportation and recreational activities in the area, such as fishing, boating, and tourism.

- Criterion #9: The property has contextual value because it is a landmark:
  - The wharf meets this criterion because it has been the site of a wharf since at least the mid-nineteenth century. As such, it has been the site of significant commercial activity to the community, many of whom relied on fishing for their livelihoods. Furthermore, until the early 1960s, the wharf site was the only access point to the village and had been used as a

stopping and departure point for tourists, particularly for those travelling by steamboat between Killarney and Manitoulin Island. It continues to be a significant destination point for tourists in the community.

Based on the recommendations of the CHER and its recommendations, the municipality will be proceeding with a Heritage Impact Assessment for the wharf prior to document the existing conditions of the wharf prior to its reconstruction.

I reviewed the evaluation of the alternative design concepts in light of the CHER findings, and I note that the CHER does not alter the results for either the cultural heritage category or for the preferred alternative design. For each criterion that contributes to the wharf's cultural heritage value, the proposed project and the preferred design generally helps to support and strengthen them. For example, the wharf meets criterion #4 as its locations and various iterations over time has had a direct association with the theme of commerce and with the activity of fishing. The CHER notes the wharf site has been busy from the arrival and settlement of fishermen in the community in the early nineteenth century through to the present. The proposed project and the preferred design will allow the local community to continue this, as continued commerce and local business development were key drivers of the project and were considered in development of the design.

We have updated the ESR to document the correspondence with MCM after the notice of completion was issued and the completion of the CHER, and the findings of the CHER have been integrated into the report. The report revision includes an errata describing the updates. We will forward you the updated version in the near future.

Jean-Louis

**Jean-Louis Gaudet, B.Sc.**
EXP | Project Coordinator
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## Jean-Louis Gaudet

| | |
|---|---|
| **From:** | Jean-Louis Gaudet |
| **Sent:** | Thursday, July 31, 2025 4:42 PM |
| **To:** | Leclerc, Erika (MCM) |
| **Cc:** | Barboza, Karla (She/Her) (MCM); Mike Cornell; sshinde@municipalityofkillarney.ca; John Sleath |
| **Subject:** | RE: MCM Response - Killarney Municipal Wharf Improvements MCEA [MCM File 0018005] |
| **Attachments:** | RE: MCM Response - Killarney Municipal Wharf Improvements MCEA [MCM File 0018005]; 2025 06 15_Killarney EA_ESR Rev1 with Errata_for MCM Review.pdf |

Hi Erica,

I am following up with you regarding the updated ESR for the Killarney Wharf Class EA, now that the CHER has been submitted to MCM for their review.

For your review and acceptance, please find attached a PDF version of the updated ESR, which includes the Errata on the updates. The ESR has been updated to address the comments MCM has provided on the ESR and to incorporate the findings of the CHER, including that the wharf has cultural heritage value and that a HIA is recommended. We also note in the ESR the various aspects of cultural heritage value that pertain to the wharf, and that the preferred design is consistent with them.

Shortly, you and cc'd will receive from me/exp a link and access to a SharePoint folder that contains:

- The attached PDF.
- The updated ESR report, with errata, in MS Word format – one version with changes tracked, and one that is clean.
- A PDF of the appendices for the updated ESR.

Please let me know if you have any issues accessing the folder or would like anyone else to have access.

As you can imagine, the Municipality is eager to obtain MCM's sign-off on this EA now that the CHER has been completed and the ESR with Errata prepared. MCM's sign-off will close the Class EA and allow the Municipality to move forward with its funders on the next steps of the project. As such, review of the provided documents at your earliest opportunity would be appreciated.

Based on our previous discussions with MCM, now that the CHER and ESR with errata is provided to MCM, our understanding of the next steps to close out the Class EA include:

- MCM signs off on both the CHER and the revised ESR.
- Updated ESR with Errata posted on the municipality's project webpage.

We would also forward a copy of the updated ESR to MECP for their records.

Please advise if your understanding is different.

Thanks Erika,

Jean-Louis

**Jean-Louis Gaudet, B.Sc.**
EXP | Project Coordinator
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**From:** Leclerc, Erika (MCM) <erika.leclerc@ontario.ca>
**Sent:** Thursday, June 19, 2025 10:44 AM
**To:** Jean-Louis Gaudet <jeanlouis.gaudet@exp.com>
**Cc:** Barboza, Karla (She/Her) (MCM) <Karla.Barboza@ontario.ca>; Mike Cornell <Michael.Cornell@exp.com>; sshinde@municipalityofkillarney.ca; John Sleath <jsleath@asiheritage.ca>
**Subject:** RE: MCM Response - Killarney Municipal Wharf Improvements MCEA [MCM File 0018005]

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Good morning Jean-Louis,

Thank you for the updates on the Killarney Municipal Wharf Improvements EA. We look forward to reviewing the CHER. Could you please also provide a copy of the revised ESR for MCM's review?

I also wanted to note that the Stage 1 AA (under PIF number P094-0330-2022) is still under MCM review. We recommend that the licensed archaeologist request an expedited review, given the timeline for the project.

Thanks again,

**Erika Leclerc**
Heritage Planner | Heritage Operations Branch | Citizenship, Inclusion and Heritage Division
Ministry of Citizenship and Multiculturalism | Ontario Public Service
416-305-0757 | erika.leclerc@ontario.ca

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## Jean-Louis Gaudet

**From:** Leclerc, Erika (MCM) <erika.leclerc@ontario.ca>
**Sent:** Friday, September 5, 2025 10:21 AM
**To:** John Sleath
**Cc:** Mike Cornell; sshinde@municipalityofkillarney.ca; Jean-Louis Gaudet; Barboza, Karla (She/Her) (MCM)
**Subject:** MCM Response - CHER - Killarney Municipal Wharf Improvements MCEA [MCM File 0018005]
**Attachments:** 2025-09-05 KillarneyWharf_DraftCHER_MCMComments.pdf

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Good morning John,

Thank you again for sending the CHER for our review. MCM's comments are attached.

Please let us know if you have any questions.

Kind regards,

**Erika Leclerc**
Heritage Planner | Heritage Operations Branch | Citizenship, Inclusion and Heritage Division
Ministry of Citizenship and Multiculturalism | Ontario Public Service
416-305-0757 | erika.leclerc@ontario.ca

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**From:** Barboza, Karla (She/Her) (MCM) <Karla.Barboza@ontario.ca>
**Sent:** July 25, 2025 4:07 PM
**To:** John Sleath <jsleath@asiheritage.ca>
**Cc:** Mike Cornell <Michael.Cornell@exp.com>; sshinde@municipalityofkillarney.ca; Jean-Louis Gaudet <jeanlouis.gaudet@exp.com>; Leclerc, Erika (MCM) <erika.leclerc@ontario.ca>
**Subject:** RE: MCM Response - Killarney Municipal Wharf Improvements MCEA [MCM File 0018005]

Hello John,

Thanks for sending the draft Cultural Heritage Evaluation (CHER) for the above referenced project to the Ministry of Citizenship and Multiculturalism (MCM) for review.

We will review and provide comments by late August.

In the meantime, please do not hesitate to contact us, should you have any questions.

Thanks again and have a great weekend!

Karla

**Karla Barboza, MCIP, RPP, CAHP (she/her)**
Team Lead, Heritage | Heritage Operations Branch | Citizenship, Inclusion and Heritage Division
Ministry of Citizenship and Multiculturalism | Ontario Public Service
416-660-1027 | karla.barboza@ontario.ca

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**From:** John Sleath <jsleath@asiheritage.ca>
**Sent:** Friday, July 25, 2025 3:26 PM
**To:** Leclerc, Erika (MCM) <erika.leclerc@ontario.ca>; Jean-Louis Gaudet <jeanlouis.gaudet@exp.com>
**Cc:** Barboza, Karla (She/Her) (MCM) <Karla.Barboza@ontario.ca>; Mike Cornell <Michael.Cornell@exp.com>; sshinde@municipalityofkillarney.ca
**Subject:** RE: MCM Response - Killarney Municipal Wharf Improvements MCEA [MCM File 0018005]

**CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.**

Hi Erika,
Please find attached the Killarney Wharf CHER completed by ASI for this project, submitted on behalf of our client EXP and the Municipality of Killarney (both cc'ed).

Our evaluation determined that the wharf has historical and associative value and contextual value in the local context.

Please let me know if you have any comments or suggest any revisions following your review.

Hope you have a great weekend,
John

**John Sleath, MA** (he/him)
Cultural Heritage Specialist | Project Manager • Cultural Heritage

**ASI • Providing Archaeological & Cultural Heritage Services**
JSleath@asiheritage.ca • 416 966 1069 x243 • Fax: 416 966 9723
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**Ministry of Citizenship and Multiculturalism**

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Ontario

September 5, 2025 Email Only

John Sleath
Cultural Heritage Specialist | Project Manager, Cultural Heritage
ASI
528 Bathurst Street
Toronto, Ontario, M5S 2P9
JSleath@asiheritage.ca

| | | |
|---|---|---|
| **MCM File** | **:** | **0018005** |
| **Proponent** | **:** | **Municipality of Killarney** |
| **Subject** | **:** | **Municipal Class Environmental Assessment – Schedule C – Cultural Heritage Evaluation Report for the Killarney Wharf** |
| **Project** | **:** | **Killarney Municipal Wharf Improvements** |
| **Location** | **:** | **Municipality of Killarney** |

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Dear John Sleath:

Thank you for providing the Ministry of Citizenship and Multiculturalism (MCM) with the Draft Cultural Heritage Evaluation Report (CHER, dated April 2025 and prepared by ASI) for the above-referenced project.

MCM's interest in this Environmental Assessment (EA) project relates to its mandate of conserving Ontario's cultural heritage.

**Comments**
The CHER concluded that the Killarney Wharf (21 Channel Street) has cultural heritage value or interest and recommends that a Heritage Impact Assessment (HIA) be prepared for the property.

We have reviewed the above-referenced CHER and find that the report is overall consistent with the requirements, guidance, and standards of the Municipal Class EA and with best practice guidance prepared by MCM.

We recommend that the HIA be completed by a qualified professional as soon as possible during detailed design and prior to any ground disturbing activities. MCM may have additional comments on this commitment once we have reviewed the revised Environmental Study Report (dated June 15, 2025).

Thank you for the opportunity to review the CHER. If you have any questions, please do not hesitate to contact me.

Sincerely,

Erika Leclerc

Heritage Planner
Heritage Planning Unit
Erika.leclerc@ontario.ca

Copied to: sshinde@municipalityofkillarney.ca
Michael Cornell, EXP
Jean-Louis Gaudet, Project Coordinator, EXP
Karla Barboza, Team Lead - Heritage Planning Unit, MCM

It is the sole responsibility of proponents to ensure that any information and documentation submitted as part of their EA report or file is accurate. The Ministry of Citizenship and Multiculturalism (MCM) makes no representation or warranty as to the completeness, accuracy or quality of the any checklists, reports or supporting documentation submitted as part of the EA process, and in no way shall MCM be liable for any harm, damages, costs, expenses, losses, claims or actions that may result if any checklists, reports or supporting documents are discovered to be inaccurate, incomplete, misleading or fraudulent.

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out an archaeological assessment, in compliance with Section 48(1) of the *Ontario Heritage Act*.

The *Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33* requires that any person discovering human remains must cease all activities immediately and notify the police or coroner. If the coroner does not suspect foul play in the disposition of the remains, in accordance with *Ontario Regulation 30/11* the coroner shall notify the Registrar, Ontario Ministry of Public and Business Service Delivery and Procurement, which administers provisions of that Act related to burial sites. In situations where human remains are associated with archaeological resources, the Ministry of Citizenship and Multiculturalism should also be notified (at archaeology@ontario.ca) to ensure that the archaeological site is not subject to unlicensed alterations which would be a contravention of the *Ontario Heritage Act*.

## Jean-Louis Gaudet

**From:** Leclerc, Erika (MCM) <erika.leclerc@ontario.ca>
**Sent:** Friday, September 19, 2025 11:47 AM
**To:** Jean-Louis Gaudet
**Cc:** Barboza, Karla (She/Her) (MCM); Mike Cornell; sshinde@municipalityofkillarney.ca; John Sleath; Kaurin, Kady (MECP); EA Notices to NRegion (MECP)
**Subject:** MCM Response - Killarney Municipal Wharf Improvements MCEA [MCM File 0018005]
**Attachments:** 2025-09-19 KillarneyWharf_UpdatedESR_MCMResponse.pdf

**Follow Up Flag:** Follow up
**Flag Status:** Flagged

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Good morning Jean-Louis,

Thank you for providing the updated ESR for MCM's review. My apologies for the delayed response! Our comments are attached.

Please do not hesitate to contact me if you have any questions.

Best regards,

**Erika Leclerc**
Heritage Planner | Heritage Operations Branch | Citizenship, Inclusion and Heritage Division
Ministry of Citizenship and Multiculturalism | Ontario Public Service
416-305-0757 | erika.leclerc@ontario.ca

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Ontario

September 19, 2025 Email Only

Jean-Louis Gaudet, B.Sc.
Project Coordinator
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1266 South Service Road, Unit C1-1
Stoney Creek, ON L8E 5R9
jeanlouis.gaudet@exp.com

| | | |
|---|---|---|
| **MCM File** | **:** | **0018005** |
| **Proponent** | **:** | **Municipality of Killarney** |
| **Subject** | **:** | **Municipal Class Environmental Assessment – Schedule C – Revised Environmental Study Report** |
| **Project** | **:** | **Killarney Municipal Wharf Improvements** |
| **Location** | **:** | **Municipality of Killarney** |

---

Dear Jean-Louis Gaudet:

Thank you for providing the Ministry of Citizenship and Multiculturalism (MCM) with the revised Environmental Study Report (ESR) for the above-referenced project (Revision dated June 15, 2025, and prepared by EXP Services Inc.) for our review and comment.

MCM's interest in this Environmental Assessment (EA) project relates to its mandate of conserving Ontario's cultural heritage.

**Comments**
MCM provided comments on a previous version of the ESR (dated January 9, 2024) on February 9, 2024, as well as additional comments on August 1, 2024. MCM and the proponent's consultants further discussed the ESR in a meeting on November 19, 2024.

In addition, MCM provided comments on the Cultural Heritage Evaluation Report (CHER, dated April 2025 and prepared by ASI) in a letter dated September 5, 2025. We found that the CHER is overall consistent with the requirements, guidance, and standards of the Municipal Class EA and with best practice guidance prepared by MCM.

We recommend that the CHER be submitted to planning staff at the Municipality of Killarney, and any other interested stakeholders, if you haven't done already. We also recommend that this engagement be reflected in the CHER or ESR.

We have reviewed the above-referenced revised ESR and find that while some of our comments have been addressed, additional revisions to the ESR are recommended to support the documentation of cultural heritage due diligence. Please see our responses in the attached table. In addition, please note that each of the recommended revisions to the ESR should also be reflected in the Errata.

Thank you for consulting MCM on this project. If you have any questions or require clarification, please do not hesitate to contact me.

Sincerely,

Erika Leclerc
Heritage Planner
Heritage Planning Unit
Erika.leclerc@ontario.ca

Copied to: Mike Cornell, EXP
Sanket Shinde, Project Coordinator, Municipality of Killarney
Kady Kaurin, Environmental Resource Planner & EA Coordinator, MECP
EA Notices to Northern Region, MECP, eanotification.nregion@ontario.ca
Karla Barboza, Team Lead, Heritage Planning Unit, MCM

It is the sole responsibility of proponents to ensure that any information and documentation submitted as part of their EA report or file is accurate. The Ministry of Citizenship and Multiculturalism (MCM) makes no representation or warranty as to the completeness, accuracy or quality of the any checklists, reports or supporting documentation submitted as part of the EA process, and in no way shall MCM be liable for any harm, damages, costs, expenses, losses, claims or actions that may result if any checklists, reports or supporting documents are discovered to be inaccurate, incomplete, misleading or fraudulent.

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out an archaeological assessment, in compliance with Section 48(1) of the *Ontario Heritage Act*.

The *Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33* requires that any person discovering human remains must cease all activities immediately and notify the police or coroner. If the coroner does not suspect foul play in the disposition of the remains, in accordance with *Ontario Regulation 30/11* the coroner shall notify the Registrar, Ontario Ministry of Public and Business Service Delivery and Procurement, which administers provisions of that Act related to burial sites. In situations where human remains are associated with archaeological resources, the Ministry of Citizenship and Multiculturalism should also be notified (at archaeology@ontario.ca) to ensure that the archaeological site is not subject to unlicensed alterations which would be a contravention of the *Ontario Heritage Act*.

| Comment # | MCM Comment (February 9, 2024) | EXP Response (July 10, 2024) | MCM Response (August 1, 2024) | MCM Response (September 8, 2025) |
|---|---|---|---|---|
| 1. | A Stage 1 archaeological assessment (AA) was completed for this project (under Project Information Form (PIF) number P094-0330-2022).<br>The report has been submitted to MCM and is awaiting review. MCM recommends that Section 8.5.1 of the ESR specify the PIF number and status of the Stage 1 AA. | Thank you for this clarification. However, to avoid confusion over report version control, EXP recommends against opening the report for this minor edit for the following reasons:<br>• The client is aware of the status of the Stage 1 AA and the report's PIF Number.<br>• Section 15.4 (Permits and Approvals) specifically notes that, at the time of the posting of the ESR for public review:<br>o The Stage 1 AA was to be submitted to MCM;<br>o The report was to be reviewed by MCM to ensure it complies with the standards and guidelines issued by the Ministry and that the archaeological field work and report | Please see our comments in the cover letter. MCM understands concerns about report version control. We recommend that the PIF number and status of the AA be documented in an erratum. | Partially addressed. For clarity, we recommend the following revision to Section 8.5.1 of the ESR:<br><br>"[…] ~~A marine archaeological assessment~~ **The study area was** screen**ing****ed** ~~was completed~~ using the Criteria for Evaluating Marine Archaeological Potential […] **checklist.** […]" |

| Comment # | MCM Comment (February 9, 2024) | EXP Response (July 10, 2024) | MCM Response (August 1, 2024) | MCM Response (September 8, 2025) |
|---|---|---|---|---|
| | | recommendations ensure the conservation, preservation, and protection of the cultural heritage of Ontario; and<br>○ A clearance letter will be issued by the Ministry once it feels all matters relating to archaeological sites within the project area have been addressed to the satisfaction of the Ministry.<br><br>We trust this description adequately conveys the status of the Stage 1 AA at the time the ESR was posted. | | |
| 2. | Please note that archaeological concerns have not been fully addressed until reports have been entered into the Ontario Public Register of Archaeological Reports where those reports recommend that: | Understood. | Please see cover letter. | Addressed. |

| Comment # | MCM Comment (February 9, 2024) | EXP Response (July 10, 2024) | MCM Response (August 1, 2024) | MCM Response (September 8, 2025) |
|---|---|---|---|---|
| | 1. the archaeological assessment of the project area is complete and<br>2. all archaeological sites identified by the assessment are either of no further cultural heritage value or interest (as per Section 48(3) of the *Ontario Heritage Act*) or that mitigation of impacts has been accomplished through excavation or an avoidance and protection strategy. | | | |
| 3. | Proponents should wait to receive the MCM's review letter indicating that the report(s) has been entered into the Register before issuing a decision or proceeding with any ground disturbing activities. | Understood. | Acknowledged. | Addressed; however, please see recommended edits under comment #5. |
| 4. | Section 8.5.1 of the ESR indicates that MCM's Criteria for Evaluating Marine Archaeological Potential: A Checklist for Non-Marine Archaeologists was completed for areas of potential in- water impacts. The ESR notes that the checklist determined the | The disturbance at and around the wharf has occurred due to past dredging and construction activities.<br><br>For example, the United States Environmental Protection Agency reported in 1974 that the Killarney | Please see cover letter. The ESR should clearly articulate how this conclusion was reached. Ideally, documentation should be included, or a summary of the information can be provided. | Partially addressed. See recommended revision under comment #1. |

| Comment # | MCM Comment (February 9, 2024) | EXP Response (July 10, 2024) | MCM Response (August 1, 2024) | MCM Response (September 8, 2025) |
|---|---|---|---|---|
| | area of potential in-water impacts has low marine archaeological potential and therefore no marine assessment is required. A copy of the checklist is provided in Appendix B. No supporting documentation was included with the checklist. The proponent should clarify with supporting documentation how it has concluded that the project area has been subjected to recent, extensive, and intensive disturbance (see question 8 of the checklist). If documentation cannot be provided, then a marine AA shall be undertaken. | Channel was a waterway with commercial status, and it was routinely dredged by the Federal Department of Public Works to maintain a 27-foot seaway depth[1].<br><br>Additionally, construction activities have taken place around the wharf periodically in recent decades that would have created disturbances. Examples of these are depicted in Attachment A through various maps and drawings. These examples include infill of the shoreline to create a parking lot at the wharf and installation of a watermain (off the west side of the wharf) to George Island, on the other side of the channel.<br><br>_____<br>1. United States Environmental Protection Agency. Future Dredging Quantities in the Great Lakes. EPA-660/3-74-029. December 1974. | | |

| Comment # | MCM Comment (February 9, 2024) | EXP Response (July 10, 2024) | MCM Response (August 1, 2024) | MCM Response (September 8, 2025) |
|---|---|---|---|---|
| 5. | Section 8.5.2 of the ESR states that MCM's Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes was completed to assess the study area, and further that there is low potential for built heritage resources and cultural heritage landscapes. A Cultural Heritage Evaluation Report (CHER) was therefore not completed for the study area.<br><br>We note that no supporting documentation was included with the checklist. Section 6.1.1 of the ESR indicates that the wharf was originally built in 1951 and that the wharf underwent significant upgrades in 2013. The answer to question 4.d should therefore have been "yes." MCM recommends that the proponent clarify with supporting documentation why a CHER is not required. If documentation cannot be provided, then a CHER shall be undertaken by a qualified person to support this EA project. | It was intended that the supporting information was included in the text and figures of ESR, and this is discussed here.<br><br>Aerial imagery shows that there are no structures on the wharf other than the Herbert Fisheries building and the boathouse.<br><br>The Herbert Fisheries building was built in 2013. While the boathouse dates to 1951 or earlier, it was not included in this assessment because of the Municipality's intention to demolish it in response to an order from the municipal building inspector, as the boathouse has been deemed unsafe. At the Municipality's June 14, 2023 council meeting, the Municipality passed Resolution 23-228, which stated that "Be it resolved that further to the Order to Comply #23-101 dated May 31, 2023 from the Chief Building Official that the Municipality of Killarney demolish the boathouse structure located at 21 Channel Street as it is a hazard to the health/safety of persons;". The boathouse has since been removed. | Please see cover letter. The wharf itself (constructed in 1951) is over 40 years old and therefore could have potential cultural heritage value or interest. The proponent should provide clarification and documentation as to why a CHER is not required. If documentation cannot be provided, a CHER shall be undertaken by a qualified person. | Partially addressed.<br><br>We recommend the following edits to Section 8.5.2 of the ESR for clarity:<br><br>"[…] the evaluation determined that the Killarney wharf has **cultural heritage value or interest. The report concluded that the property has** historical and associative value as well as contextual value […] It continues to be a significant destination point for tourists in the community. **The recommendations of the CHER are discussed in Section 15.1. A copy of the CHER is included in Appendix B-3 of this report.**"<br><br>We also recommend the following revisions to Table 2 (Section 10), under Cultural Environment, Indicators column:<br>• "~~Loss and/or disturbance of~~ **impacts to** archaeological resources **or areas of archaeological potential**"<br>• ~~Loss and/or disturbance of~~ **Direct or indirect impacts to known and potential built heritage resources and** cultural heritage ~~resources~~ **landscapes**<br><br>These same edits are recommended for Table 5 (Section 12.1). |

| Comment # | MCM Comment (February 9, 2024) | EXP Response (July 10, 2024) | MCM Response (August 1, 2024) | MCM Response (September 8, 2025) |
|---|---|---|---|---|
| | | Given the above, it was concluded that there are no buildings or structures on the wharf more 40 years old than would be impacted by the proposed works, and therefore the response to 4d was "no". | | In addition, Table 4 (Section 10.2) and Table 7 (Section 12.2) should be revised to align with the Criteria as described in Tables 2 and 5, as well as the findings of the CHER. The Wharf was found to have cultural heritage value or interest. Alternatives 1 and 2 (as well as design concepts A and B) have the potential to impact the property – the HIA will determine impacts and recommend mitigation measures. The evaluation of the alternatives/designs should reflect this information. Furthermore, we recommend that these tables address impacts to built heritage resources/cultural heritage landscapes separately from archaeological resources, using either separate rows or bullets.<br><br>Similarly, the tables in Appendix C and D should be revised to reflect our above comments. In addition, these tables should be updated to include the results of the completed *Criteria for Evaluating Marine Archaeological Potential* checklist (indicate that there is low potential for marine archaeological resources and therefore no impacts are anticipated).<br><br>Furthermore, we recommend revising Table 12 (Section 15.1) (and the Errata) to specify the timeline for completion of the HIA and include <u>all</u> of the CHER's recommendations. The table should also be revised for consistency with the requirements of the |

| Comment # | MCM Comment (February 9, 2024) | EXP Response (July 10, 2024) | MCM Response (August 1, 2024) | MCM Response (September 8, 2025) |
|---|---|---|---|---|
| | | | | *Ontario Heritage Act* and the *Funeral, Burial and Cremation Services Act* with respect to the discovery of human remains and undocumented archaeological resources. We also recommend including a bullet addressing marine archaeological resources.<br><br>MCM recommends the following revisions to Table 12, under Cultural Environment:<br><br>Potential Impacts column:<br>• "The Class EA's Stage 1 Archaeological Assessment (see Appendix B-1) **determined that the study area does not have** ~~indicated low potential for~~ archaeological potential. […]<br>• **The study area was screened using MCM's *Criteria for Evaluating Marine Archaeological Potential* checklist and it was determined that there is low potential for marine archaeological resources. No impacts to marine archaeological resources are anticipated to result from the project.**<br>• The **Cultural Heritage Evaluation Report (CHER) completed for the wharf (see Appendix B-3) determined that the** wharf itself has cultural heritage value or interest […]" |

| Comment # | MCM Comment (February 9, 2024) | EXP Response (July 10, 2024) | MCM Response (August 1, 2024) | MCM Response (September 8, 2025) |
|---|---|---|---|---|
| | | | | • "~~The preferred design is consistent with the cultural heritage components noted~~ **The CHER recommended that a Heritage Impact Assessment (HIA) be completed to evaluate the potential impacts to the property. The CHER states that fieldwork, including photographic documentation of the structure and surroundings, should be carried out as part of the HIA to confirm the existing conditions of the wharf and serve as a record prior to its reconstruction.**<br><br>Proposed Mitigation Measures column:<br>• If **previously undocumented** archaeological resources are unexpectedly encountered during construction, **they may be an archaeological site and subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site** ~~all activities impacting them must cease~~ immediately~~, MCM must be notified (at archaeology@ontario.ca)~~ and a licensed consultant archaeologist must be retained to carry out an archaeological assessment in |

| Comment # | MCM Comment (February 9, 2024) | EXP Response (July 10, 2024) | MCM Response (August 1, 2024) | MCM Response (September 8, 2025) |
|---|---|---|---|---|
| | | | | accordance with the Ontario Heritage Act and the 2011 Standards and Guidelines for Consultant Archaeologists. In the event hat human remains are encountered, **consistent with the requirements of the Funeral, Burial and Cremation Services Act,** all activities must cease immediately and the local police and coroner must be contacted.<br>• **If the coroner does not suspect foul play in the disposition of the remains, in accordance with Ontario Regulation 30/11 the coroner shall notify the Registrar, Ontario Ministry of Public and Business Service Delivery and Procurement, which administers provisions of that Act related to burial sites. In situations where human remains are associated with archaeological resources, the Ministry of Citizenship and Multiculturalism should also be notified (at archaeology@ontario.ca) to ensure that the archaeological site is not subject to unlicensed alterations which would be a contravention of the *Ontario Heritage Act.***|

| Comment # | MCM Comment (February 9, 2024) | EXP Response (July 10, 2024) | MCM Response (August 1, 2024) | MCM Response (September 8, 2025) |
|---|---|---|---|---|
| | | | | • ~~A Cultural Heritage Evaluation Report (CHER) was prepared confirming the wharf has cultural heritage value~~. A Heritage Impact Assessment (H.I.A.) of the wharf will be completed **by a qualified professional as early as possible during detailed design and prior to any demolition, removal or alteration** to evaluate the expected impacts to the property and document the existing conditions of the wharf prior to its reconstruction **and recommend mitigation measures."**<br><br>We also recommend the following revisions to Section 15.4:<br><br>"15.4 Permits ~~and~~**,** Approvals **and Legislative Requirements** […]<br><br>• ~~Archaeological Assessment Clearance Letter from MCM~~ **Entry of the Stage 1 Archaeological Assessment into the Ontario Public Register of Archaeological Reports**: The Stage 1 Archaeological Assessment prepared for this Class EA was submitted to MCM and is awaiting review and entry into the Ontario Public Register of Archaeological Reports. ~~The report is reviewed by~~ |

| Comment # | MCM Comment (February 9, 2024) | EXP Response (July 10, 2024) | MCM Response (August 1, 2024) | MCM Response (September 8, 2025) |
|---|---|---|---|---|
| | | | | ~~the Ministry to ensure it complies with the standards and guidelines issued by the Ministry and that the archaeological field work and report recommendations ensure the conservation, preservation, and protection of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area have been addressed to the satisfaction of the Ministry, a letter will be issued by the Ministry stating that there are no further concerns with regards to alterations to archaeological sites by the proposed works.~~ **Archaeological concerns have not been fully addressed until reports have been entered into the Ontario Public Register of Archaeological Reports where those reports recommend that:**<br>**1) the archaeological assessment of the project area is complete and**<br>**2) all archaeological sites identified by the assessment are either of no further cultural heritage value or interest (as per Section 48(3) of the *Ontario Heritage Act*) or that mitigation of impacts has been accomplished through excavation or an** |

| Comment # | MCM Comment (February 9, 2024) | EXP Response (July 10, 2024) | MCM Response (August 1, 2024) | MCM Response (September 8, 2025) |
|---|---|---|---|---|
| | | | | **avoidance and protection strategy.**" |