S Army Corps
of Engineers
North Central Division

Great Lakes Update

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Dredged Material Testing & Evaluation

The U.S. Environmental Protection Agency (USEPA) and U.S. Army Corps of Engineers (USACE or Corps) have released two draft manuals on the testing and evaluation of dredged material for public review and comment. These manuals represent a significant change m the past methods used in Great Lakes, and may cause some changes to the way dredging projects are planned and dredged material managed.

Dredging Background

Dredging is the removal of rock, sand, gravel, mud and clay from the bottom of waterways to create or maintain sufficient depth for navigation or other purposes.

Nearly all Federal harbors on the Great Lakes are located at the mouth of a river or along the coastline, utilizing natural or dredged navigation channels. Lake and river currents transport sand and silt, eroded from the stline and watershed, which y become deposited in navigation channels.

If unabated, these natural processes would eventually lead to the filling of vital harbors and waterways, with sand, mud or clay, causing vessel delays and groundings. Dredging is necessary to maintain America's waterborne commerce and defense capability. Today's ore carriers, container ships, oil tankers and Coast Guard vessels need deep channels and docking facilities to move freely.

In addition, sediments are routinely dredged from waterways for other purposes, including recreational navigation, waterfront development, pipeline or cable placement and clearing water intakes. Figure 1 shows a mechanical dredging operation.

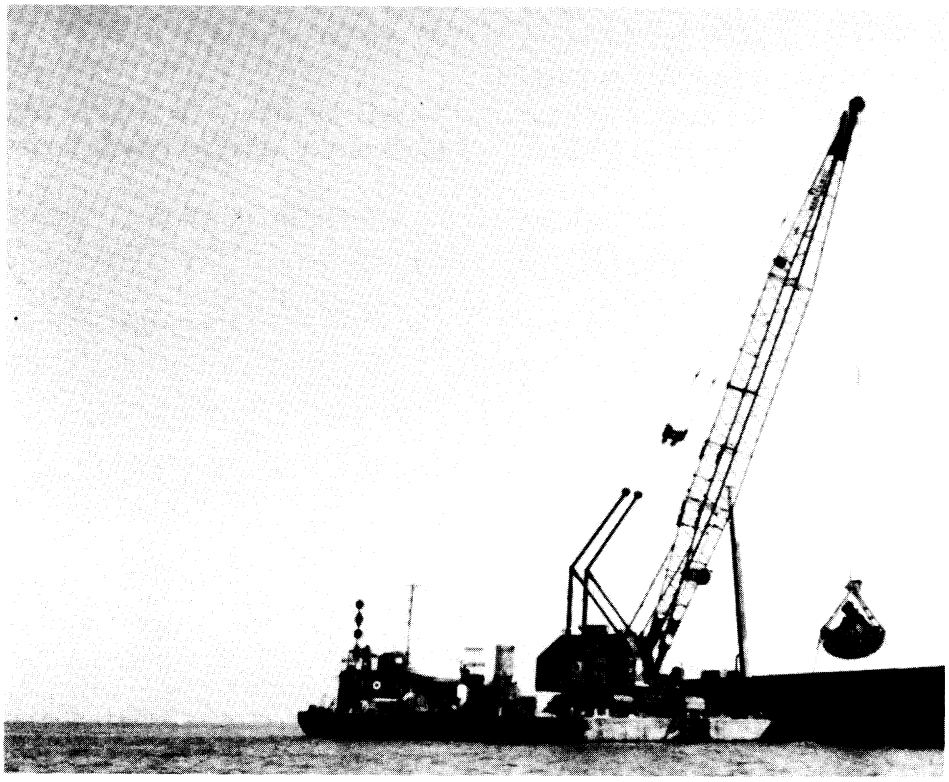

Figure 1. Typical mechanical dredging operation.

Approximately 400 million cubic yards of sediments are dredged in the United States annually. In comparison, the volume of material dredged annually from the U.S. portion of the Great Lakes is between 5-7 million cubic yards. Most of this (about 4 million cubic yards) is dredged by the Corps in response to regularly scheduled maintenance of 131 Federal navigation projects around the Great Lakes.

Dredged Material Management

The management of dredged material has been a controversial topic for many years due to the potential for adverse environmental impacts. Several major research programs have studied the subject in an effort to deal with this controversy (Buffalo District 1969; Saucier et al. 1978; Averett et al. 1990).

The Corps and the USEPA have cooperated in developing a technical framework for evaluating dredged material management alternatives (USACE/USEPA 1992). Using this framework as a guide, decision makers are able to identify environmentally acceptable management alternatives. Three general types of management alternatives for dredged material are: open water disposal; beneficial uses; and, confined disposal.

Open Water Disposal: Open water disposal is the unrestricted placement of dredged material in a waterway. This alternative is only acceptable for dredged material which does not cause contaminant-related impacts. Around the Great Lakes, almost half of the dredged material is disposed of in this way, typically within a few miles of shore. Most of these disposal sites are dispersive, where the placed materials circulate as the result of currents and wave energies in the shallow, near-shore waters. Typical costs for dredging and open water disposal are about $2-$7 per cubic yard.

Beneficial Use: Beneficial use alternatives include beach nourishment (Figure 2), use as a soil amendment, or use as construction fill material. Dredged material that has a sandy texture is especially suitable for use beach nourishment and as a construction material. The amount of dredged material from the Great Lakes which is suitable for beneficial use is increasing. Uses for silty sediments, however, are more difficult to identify. The costs for beneficial use can be comparable to that for open water disposal, depending on material transportation requirements, distances involved and the availability of local proponents or sponsors.

Confined Disposal: Often sediments are found to be contaminated and open water disposal and beneficial use alternatives are not acceptable. Contaminants come from a number of sources including industrial and municipal wastewater discharges, chemical spills, sewer overflows, and urban and agricultural runoff. Contaminants can have significant adverse impact on the water quality and aquatic life if the dredged material is not properly managed.

Confined disposal is the placement of dredged material at a site or in a facility where the sediments and associated contaminants can be controlled. Level bottom capping and contained aquatic disposal (CAD) are options for the subaqueous confinement of contaminated dredged material which have been used extensively in New England and New York.

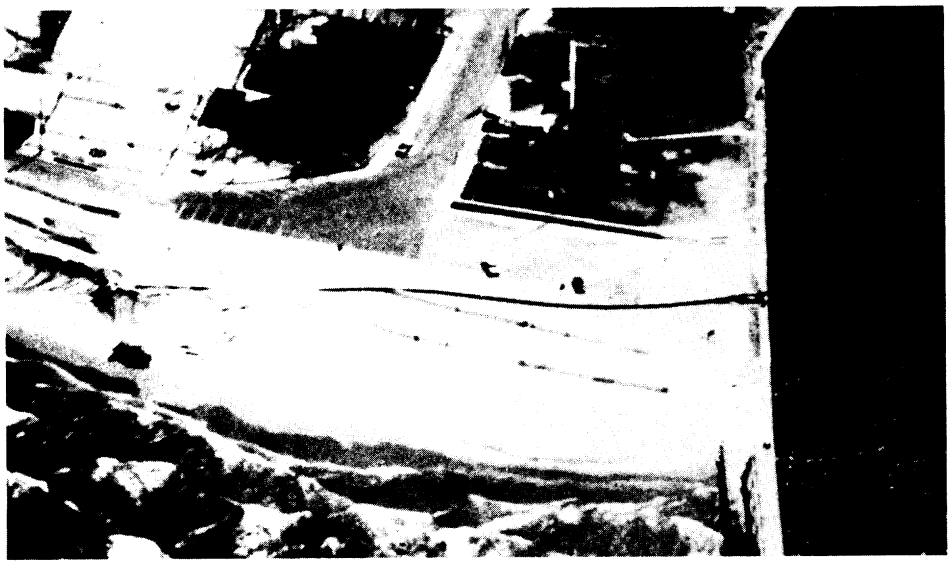

Figure 2. Aerial view of beach nourishment at Manistee Harbor, Michigan.

Confined disposal facilities (CDFs) are diked areas on land or in water, where dredged material can be placed and confined. Since the mid 1960s, 43 CDFs have been constructed by the Corps for the disposal of contaminated sediments from Great Lakes harbors (Figure 3) in cooperation with local or state government sponsors. Current costs for dredging with placement in a CDF are around $10-$25 per cubic yard.

In-place contaminated sediments, identified as a significant problem at most of the Great Lakes areas of concern, are the subject of the USEPA's Assessment and Remediation of Contaminated Sediments (ARCS) program (See Update Letter No. 83, dated June 4, 1992). Under the ARCS program a number of advanced treatment technologies were demonstrated in pilot-scale projects. The estimated costs of applying advanced treatment technologies to contaminated dredged material are in the range of $100-$500 per cubic yard.

Dredged Material Regulation

Prior to 1970, decision making about the discharge of dredged material was primarily based on economics. With the development of water quality criteria and standards, concerns over the discharge of dredged material necessitated development of procedures for evaluating the potential effects of dredged material disposal.

In the early 1970s, numerical criteria consisting of seven physical and chemical parameters (known as the Jensen criteria) were used for determining the acceptability of dredged material disposal into the nation's waters. The USEPA Region 5 later developed an expanded set of numerical criteria for classifying sediments from Great Lakes harbors.

Currently the discharge of dredged or fill materials to waters of the U.S. is regulated under the Clean Water Act (CWA) of 1972, as amended. CWA Section 404 designates the Corps as the lead federal agency in the regulation of dredge and fill activities using Guidelines developed by the USEPA in conjunction with the Corps.

The CWA amendments of 1972 directed that decision making about proposed disposal of dredged or fill material be made using the evaluation procedure contained in Section 404(b)(1). This section requires the application of Guidelines developed by the USEPA in conjunction with the Corps, and that these Guidelines be based on criteria comparable to those developed for ocean dumping. In accordance with Section 404(b)(1) Guidelines were developed in 1975 and finalized in 1980.

Compliance with the Guidelines requires consideration of the potential effects of the dredged material discharge on the physical, chemical and biological characteristics of the disposal site, potential impacts on special aquatic sites (i.e., wetlands, sanctuaries, etc.), and potential effects on human uses of the waterway. Potential contaminant-related impacts are only one of the factors considered under the Guidelines, but are often the most critical to the decision.

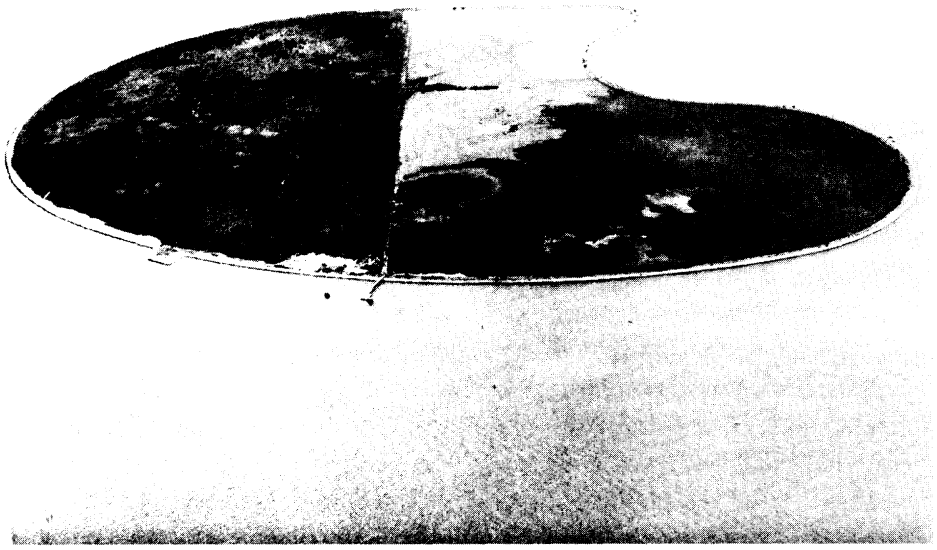

Figure 3. Saginaw Bay Confined Disposal Facility, Saginaw, MI.

Required Permits

Permits for the discharge of dredge or fill material into the U.S. waters of the Great Lakes are issued through Corps district offices in Buffalo, Chicago, Detroit and St. Paul. The Corps has cooperative permitting programs with many States. Transfer of Section 404 permitting responsibilities to the States is provided for under the CWA. To date, however, this authority has been transferred to only one state, the State of Michigan.

The Corps does not issue permits to itself in connection with disposal of dredged material from Corps conducted maintenance dredging projects. The Corps prepares an evaluation as required by Section 404(b)(1) of the CWA. The Corps must also comply with the substantive and procedural requirements of the applicable State environmental regulations.

Section 401 of the CWA provides the States with authority to issue a certification for dredge and fill disposal activities. This certification states that the proposed fill or dredged disposal will not violate applicable State water quality standards. The Corps obtains 401 certification from State agencies for the disposal of dredged material to the open lake and for the discharge (effluent) from a confined disposal facility.

National Testing Guidance

The Guidelines, developed in 1975 and finalized in 1980, were very general and offered no specific guidance on testing procedures. An interim document (USACE, 1976) provided limited testing guidance but is well out of date. The USEPA and the Corps completed an update of the dredged material testing manual for ocean waters in 1991, and in 1992 began working together on a dredged material testing manual for inland waters.

In the July 21, 1994 Federal Register, the USEPA and the Corps announced that the new manual, known as the Inland Testing Manual, was made available for public review and comment. It is applicable to all dredged material discharges regulated under the CWA, including the Corps, and permitted dredged material disposal.

Tiered Evaluation System

The USEPA and the Corps have adopted a tiered approach for the evaluation of dredged material (Figure 4). The objective is to focus limited resources on the most critical information and data needed to make a decision.

In each of the first three tiers, one of three possible decisions is made: 1) the information is sufficient to determine that there will be no unacceptable contaminant impacts; 2) the information is sufficient to determine that there will be unacceptable contaminant impacts; and, 3) the information is not sufficient to make a determination. In the latter case, additional testing is required at the next higher tier.

The potential impacts of dredged material contaminants at the disposal site are evaluate along two pathways: water col umn and benthic. The potential impacts on the water column which might occur as dredged material is discharged and settles to the bottom are relatively transient. The more significant pathway for contaminant impacts is to benthic organisms which may colonize the dredged material after placement.

Tier 1: The tiered system begins with a "reason-to-believe" evaluation. Historic information about the dredging site and potential sources of contamination are evaluated to determine if there is a reason to believe the sediments are contaminated. If the historical data indicate the sediments are not contaminated no testing is necessary. If historical information is not sufficient to make a determination, the data can at least be used to identify the project-specific contaminants of concern.

Tier 2 utilizes physical and chemical data on the dredged material to determine the potential for contaminant effects. Screening level tools, including mathematical models, are used with sediment chemical data to determine if there are potential water quality or benthic bioaccumulation problems.

Elutriate tests, made by mixing dredged material and water and separating the solids by centrifugation, are used t

determine if the dredged material discharge will meet State water quality standards.

Decisions at tier 2 are often limited by the inability to predict biological effects from sediment physical and chemical properties alone. As a result, most evaluations which enter tier 2 will pass into tier 3.

Tier 3 utilizes biological effects-based tests to evaluate potential water column and benthic impacts from dredged material contaminants. The tests expose aquatic organisms to whole sediments (benthic impacts), or an elutriate preparation (water column impacts). Survival (mortality) and bioaccumulation (body burden of contaminants) are the responses measured in the test organisms.

The results of water column (elutriate) toxicity tests are evaluated to determine if a threshold level is exceeded outside the mixing zone. Benthic toxicity and bioaccumulation results with organisms exposed to the proposed dredged material are compared to results with a reference sediment. The reference sediment is collected from the proposed disposal site, or nearby.

Tier 4: If testing in tiers 1-3 has not provided sufficient information for a determination, the evaluation enters tier 4. Tier 4 involves tests for which the procedures and interpretation are developed on a project specific is. It is expected that tier 4 sting should rarely be required for a determination.

Regional Testing Guidance

The 404(b)(1) Guidelines encourage the development of regional guidance on dredged material testing and evaluation to complement national guidance. Regional guidance is appropriate to reflect the specific conditions, types of contaminants, and test organisms most relevant to the regional waterways.

The offices of the USEPA and the Corps around the Great Lakes (USEPA Regions 2, 3, and 5 and the Corps' North Central Division) have jointly developed a regional testing manual which will be applicable to all dredged material discharges to the U.S. waters of the Great Lakes basin.

The "Great Lakes Dredged Material and Testing Manual" (Figure 5) is currently being published for public review and comment. This Great Lakes Manual uses the same tiered testing system as the Inland Testing Manual, but provides more detailed guidance on contaminants of concern, historical data sets, sediment sampling, quality assurance, and testing methods appropriate to the Great Lakes. For example, the manual includes toxicity and bioaccumulation tests for six organisms native to the Great Lakes.

Projected Effects

The new testing manuals will provide a procedure for evaluating potential contaminant effects of dredged material discharges in inland waters which is more consistent with the procedures used in the oceans and employs methods which are more scientifically defensible and protective of the environment.

The new manuals will change the way dredged material evaluations are conducted, both by the Corps and applicants for Section 404 permits involving dredged material disposal. Most Section 404 permits involving the filling of wetlands will not be affected.

Some proposed dredged disposal projects will reach a determination in tier 1. This is most likely for projects which are remote from sources of contamination or have historical test results indicating the absence of contamination in the dredged material. For most of the remaining projects, testing from tiers 2 and 3 will be needed to support a determination.

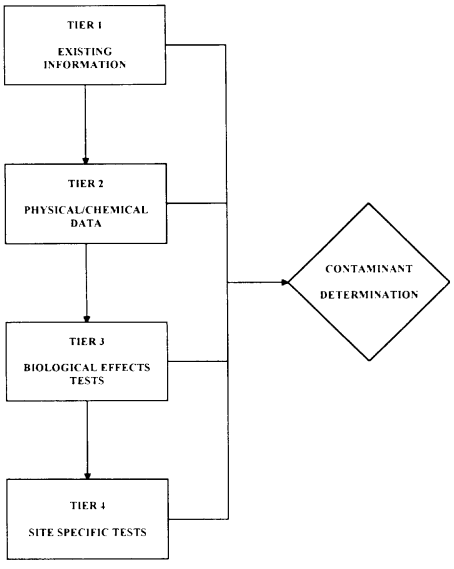

Figure 4. Tiered Evaluation System.

Because of the complexity and cost of biological testing procedures, testing will likely be performed on a limited number of samples. As a result, the need for advance coordination of plans for sampling and testing will be critical and the level of documentation required for data collection plans and quality assurance will increase.

Corps districts have begun to apply the new testing procedures at selected navigation projects and will continue to phase in the application of the new manuals while they are under review. Permit applicants will not be required to use the manuals until they have been finalized.

Public Review and Comment

The "Inland Testing Manual" was released for a 90-day public review on July 21, 1994. To obtain a copy, write or call: Ms. Shirley Walker, IM-MI-R, U.S. Army Engineer Waterways Experiment Station, 3909 Halls Ferry Road, Vicksburg, MS 39180-6199. Telephone: (601)-634-2571

The "Great Lakes Dredged Material Testing and Evaluation Manual" is being released for public review as this update letter is in publication. To obtain a copy, write to: Mr. Jan Miller, CENCD-PE-ED-WL, U.S. Army Engineer Division, North Central, 111 North Canal Street, Chicago, IL 60606-7205

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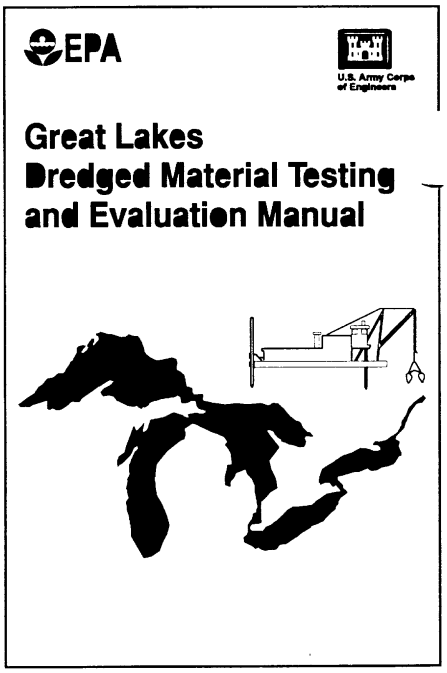

Figure 5. "Great Lakes Dredged Material and Testing Manual".

USEPA/NCD. 1994 (draft). **"Great Lakes Dredged Material Testing and Evaluation Manual"**, USEPA Regions 2, and 5 and U.S. Army Engin Division, North Central, Chicago, IL.

USEPA/USACE. 1994 (draft). **"Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Testing Manual (Inland Testing Manual)"**, EPA-823-B-94-002, Washington, DC.

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Table 1

Possible Storm Induced Rises (in feet) at Key Locations on the Great Lakes September 1994

	Degrees of Possibility				
	20%	10%	3%	2%	1%
LAKE SUPERIOR					
Duluth	0.7	0.8	1.0	1.0	1.1
Grand Marais	0.5	0.6	0.6	0.7	0.7
Marquette	1.0	1.1	1.3	1.5	1.6
Ontonagon	0.6	0.8	1.1	1.3	1.4
Point Iroquois	1.0	1.1	1.3	1.5	1.6
Two Harbors	0.7	0.9	1.1	1.3	1.5
LAKE MICHIGAN					
Calumet Harbor	1.2	1.5	1.9	2.1	2.4
Green Bay	1.6	1.9	2.3	2.6	2.9
Holland	0.6	0.7	0.9	1.0	1.0
Kewaunee	0.7	1.0	1.6	2.1	2.7
Ludington	0.7	0.8	0.8	0.9	1.0
Milwaukee	0.8	0.9	1.0	1.0	1.1
Port Inland	1.0	1.1	1.2	1.3	1.4
Sturgeon Bay	0.7	0.8	1.0	1.1	1.2
LAKE HURON					
Detour Village	0.5	0.5	0.5	0.5	0.5
Essexville	1.6	1.8	2.0	2.2	2.4
Harbor Beach	0.7	0.7	0.8	0.8	0.9
Harrisville	0.4	0.5	0.6	0.6	0.7
Lakeport	1.0	1.3	1.6	1.9	2.2
Mackinaw City	0.8	0.9	1.1	1.2	1.7
LAKE ST. CLAIR					
St. Clair Shores	0.4	0.4	0.5	0.5	0.6
LAKE ERIE *					
Barcelona	1.4	1.7	2.0	2.2	2.4
Buffalo	3.0	3.6	4.4	5.0	5.6
Cleveland	1.0	1.2	1.5	1.7	1.9
Erie	1.3	1.5	1.7	1.9	2.0
Fairport	0.7	0.9	1.0	1.2	1.3
Fermi Power Plant	1.4	1.6	1.9	2.1	2.2
Marblehead	1.1	1.2	1.4	1.6	1.7
Sturgeon Point	2.3	2.6	3.1	3.4	3.7
Toledo	1.8	2.2	2.6	3.0	3.4
LAKE ONTARIO					
Cape Vincent	0.6	0.8	0.9	1.0	1.1
Olcott	0.5	0.6	0.7	0.8	1.0
Oswego	0.6	0.7	0.8	0.9	1.0
Rochester	0.5	0.6	0.7	0.7	0.8

* The water surface of Lake Erie has the potential to tilt in strong winds, producing large differentials between the ends of the lake.

Note: The rises shown above, should they occur, would be in addition to the still water levels indicated on the Monthly Bulletin. Values of wave runup are not provided in this table.

Great Lakes Basin Hydrology

During the month of August precipitation on each of the Great Lakes basins was above average. For the year to date, precipitation on the entire Great Lakes basin has been about 6% above average. The net supply of water to all of the Great Lakes was above average in August. Table 2 lists August precipitation and water supply information for all of the Great L'

In comparison to their long-term (1918-1993) averages, the August monthly mean water level of Lake Superior was at its long-term average, and the levels of Lakes Michigan-Huron, St. Clair, Erie and Ontario were 8, 13, 11 and 2 inches above average respectively. Shoreline residents are cautioned to be alert whenever adverse weather conditions exist, as these could cause rapid short-term rises in water levels. Should the lakes approach critically high levels, further information and advice will be provided by the Corps of Engineers.

TABLE 2
GREAT LAKES HYDROLOGY[1]

PRECIPITATION (INCHES)

BASIN	AUGUST				YEAR-TO-DATE			
	1994[2]	Average (1900-1991)	Diff.	% of Average	1994[2]	Average (1900-1991)	Diff.	% of Average
Superior	3.8	3.2	0.6	119	19.6	19.5	0.1	101
Michigan-Huron	4.6	3.1	1.5	148	23.3	20.6	2.7	113
Erie	4.0	3.2	0.8	125	23.6	23.6	0.0	100
Ontario	4.0	3.1	0.9	129	23.6	22.9	0.7	103
Great Lakes	4.2	3.1	1.1	135	22.3	21.0	1.3	106

LAKE	AUGUST WATER SUPPLIES[3] (CFS)		AUGUST OUTFLOW[4] (CFS)	
	1994[2]	Average (1900-1989)	1994[2]	Average (1900-1989)
Superior	117,000	101,000	78,000	84,000
Michigan-Huron	93,000	55,000	200,000[5]	195,000
Erie	-3,000	-12,000	225,000[5]	207,000
Ontario	14,000	8,000	272,000	253,000

[1]Values (excluding averages) are based on preliminary computations.
[2]Estimated.
[3]Negative water supply denotes evaporation from lake exceeded runoff from local basin.
[4]Does not include diversions.
[5]Reflects effects of ice/weed retardation in the connecting channels.

CFS = cubic feet per second.

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