FINDING OF NO SIGNIFICANT IMPACT (FONSI)

The U.S. Army Corps of Engineers, Buffalo District has assessed the environmental impacts of the following operations and maintenance activities in accordance with the National Environmental Policy Act of 1969:

Dredging
and
Open-Lake and Confined Disposal of Dredged Materials
Toledo Harbor, Lucas County, Ohio

An estimated 700,000 cubic yards of material would be dredged from Toledo Harbor in 1989, from the area between River Mile 2 through Lake Mile 10. Sediments dredged upstream of Lake Mile 2 (200,000 cubic yards est.) would be placed in the Toledo Harbor Confined Disposal Facility (CDF); sediments dredged lakeward of Lake Mile 2 (500,000 cubic yards est.) would be discharged at a proposed open-lake disposal site. This FONSI and Environmental Assessment (EA) also pertains to the discharge of an unspecified quantity of polluted dredged materials by private interests in the CDF.

The attached EA evaluates the environmental impacts resulting from the use of the proposed open-lake disposal site and incorporates new sediment analysis data into Toledo Harbor's Final Environmental Impact Statement (FEIS) for Operations and Maintenance (1976).

All reasonable alternatives to the proposed dredging and disposal activities have been considered, and it has been determined that open-lake disposal of unpolluted sediments and confined disposal of polluted sediments from the harbor would be the preferred disposal alternative. The "no action" alternative has been considered, but was dismissed since it would do nothing to address commercial navigation needs at Toledo Harbor.

Analysis of the physical, chemical, and biological characteristics of bottom sediments at the proposed open-lake disposal site and the Federal Navigation Channel indicates they are comparable. Evaluation of the proposed use of the new open-lake disposal site and updated sediment quality information has indicated that no additional significant environmental impacts would be attributed to the scheduled dredging and disposal activities and a supplement to Operations and Maintenance FEIS (1976) is not required.

HUGH F. BOYD III
Colonel, U.S. Army
Commanding

Date: 18 Aug 89

OPERATIONS AND MAINTENANCE
TOLEDO HARBOR
LUCAS COUNTY, OHIO

ENVIRONMENTAL ASSESSMENT
AND
FINDING OF NO SIGNIFICANT IMPACT

U.S. Army Engineer District, Buffalo
1776 Niagara Street
Buffalo, New York 14207-3199

February 1989

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The attached EA presents the results of the environmental analysis. Those who have information which might alter this assessment and lead to a reversal of this decision should notify me within 30 days.

HUGH F. BOYD III
Colonel, U.S. Army
Commanding

Date:_____

OPERATIONS AND MAINTENANCE
TOLEDO HARBOR
LUCAS COUNTY, OHIO

ENVIRONMENTAL ASSESSMENT

U.S. Army Engineer District, Buffalo
1776 Niagara Street
Buffalo, New York 14207-3199

February 1989

OPERATIONS AND MAINTENANCE
DREDGING
AND
OPEN-LAKE AND CONFINED DISPOSAL
TOLEDO HARBOR
LUCAS COUNTY, OHIO

ENVIRONMENTAL ASSESSMENT

1. PURPOSE AND NEED

1.1 Purpose of the Environmental Assessment (EA). The purpose of this EA is to evaluate the impacts of the use of a new open-lake disposal site and to update previous environmental documents on the operations and maintenance of Toledo Harbor. This EA provides information on the potential effects of scheduled dredging and disposal activities to determine if proposed project modifications and new sediment analysis data would result in significant impacts affecting the quality of the human environment. This EA facilitates compliance with the National Environmental Policy Act and includes discussions of the need for the action, its environmental impacts, alternatives, and a list of agencies, interested groups, and individuals consulted.

1.2 Need for Proposed Action. The existing project was authorized by the 1899, 1910, 1950, 1954, 1958, and 1960 River and Harbor Acts to provide for commercial navigation in Toledo Harbor. Dredging is performed annually to remove shoals that develop in the channel from sediments deposited by the Maumee River as it enters the Maumee Bay section of Lake Erie. Since 1974, over 958,000 cubic yards of sediment have been dredged annually at the harbor and placed at various disposal sites. From 1983 through 1988, annual dredging quantities have averaged about 780,000 cubic yards.

1.3 The open-lake site is a newly proposed site which has been selected to address public concerns related to past disposal operations and their impact on public water supplies for the cities of Toledo and Oregon, Ohio.

1.4 Affected Environment. Toledo Harbor is located in Lucas County, Ohio, at the western end of Lake Erie about 110 miles west of Cleveland, Ohio, and 40 miles south of Detroit, Michigan (Figure EA-1). The proposed open-lake disposal site, located in the western basin of Lake Erie, is situated on an azimuth of 33° at a distance of 3.5 miles from the Toledo Harbor Light. Water depths at the site range from 20 to 23 feet below LWD (1). In response to a recommendation by the city of Toledo - Division of Water (9 January 1989), only the northeast half of the site would be utilized. The Toledo Harbor CDF is located immediately southeast of the Federal Navigation Channel at Lake Mile 2, about 355 feet northeast of the Toledo Edison Company's Bayshore Station. The facility borders the Toledo-Lucas County Port Authority and Toledo Edison Company Disposal Areas located immediately to the southwest.

(1) Low water datum for Lake Erie is 568.6 feet above mean sea level at Father Point, Quebec, Canada.

1.5 Toledo's manufacturing base is largely dependent on the automotive industry centered in Detroit. Extensive oil refineries and headquarters for four of the nation's leading glass firms. Thirty-seven piers, wharves, and docks are in use at Toledo Harbor. Seven are located on Maumee Bay, east of the mouth of the Maumee River and the remaining 30 are equally divided along the right and left banks of the lower 7 miles of the Maumee River (U.S. Army Corps of Engineers, Buffalo District, 1983).

1.6 The Toledo Harbor CDF completed in 1976, covers an area of about 242 acres. From 1976 through 1984, all material dredged from the harbor was placed in the CDF. Sediment analyses conducted in 1983 showed a significant reduction in the volume and extent of highly polluted sediments, and it was agreed that a portion of the harbor sediments no longer required confined disposal and could be placed in the open lake. This resulted in the first open-lake disposal operation at Toledo in almost 10 years.

1.7 Analysis of bottom sediments from the proposed open-lake disposal site was conducted in 1987 (T.P. Associates International, Inc., 1987). This evaluation included particle size analysis, bulk chemical analyses, bioassay testing, and a benthic organism inventory. Bottom sediments at the proposed open-lake site were found to consist primarily of silts and clays. Particle size analysis of these sediments indicated that from 45.3 to 96.4 percent of the material passed through the No. 200 sieve. The benthic survey of the site indicated a predominant faunal assemblage of chironomids and oligochaetes and a somewhat limited species diversity. Bulk chemical analysis of the bottom material indicated "highly polluted" levels for cyanide and total phosphorus (Appendix EA-B, Tables 1 and 3). Arsenic, barium, COD, lead, and TKN were within the "highly polluted/moderately polluted" range. "Moderately polluted" contaminant levels were recorded for chromium, copper, manganese, nickel, ammonia-nitrogen, total volatile residue, and zinc.

1.8 Particle size analysis of the harbor sediments indicated that from 61.1 to 98.0 percent of the material passed through the No. 200 sieve, thereby classifying them as primarily silts and clays. Bulk chemical analysis of these sediments indicated "nonpolluted" to "moderately polluted" contaminant levels at Stations L-16 through L-1, except for arsenic, barium, cyanide, and phosphorus which were within the "highly polluted" range at a number of these sites (Appendix EA-B, Tables 2 and 3). Arsenic levels at the lake channel sites ranged from 9 to 22 ug/g, and ranged from 12 to 23 ug/g at the river sites. Barium levels were measured in the "moderately polluted" range at Stations L-9 and L-11 through L-16 and in the "highly polluted" range for the remainder of the stations. Phosphorus levels were elevated at most lake stations and all river stations. Cyanide levels were less than 1 ug/g at all sampling locations except for L-1 (1.5 ug/g) and R-1 (1.58 ug/g). Volatile halocarbons, organochlorine pesticides, and polychlorinated biphenyls were not detected at any of the sampling locations. Generally, it has been concluded that the physical, chemical, and biological characteristics are consistent with those of the bottom sediments at the proposed open-lake disposal site.

1.9 The area of concern lies within the range of a Federal endangered species - bald eagle (Haliaeetus leucocephalus). However, no critical habitat for this species is present in the impact area.

1.10 Consultation with the National Register of Historic Places has indicated that no significant historic properties of archaeological sites are known to exist in the affected areas.

2. PROJECT PLANS AND ALTERNATIVES

2.1 The Proposed Action. From 1983 through 1988, annual dredging quantities at Toledo Harbor have averaged about 780,000 cubic yards. An estimated 700,000 cubic yards of material would be dredged from the harbor in 1989, from the area between River Mile 6 through Lake Mile 10 (Figure EA-1). Sediment dredged upriver of Lake Mile 2 (approximately 200,000 cubic yards) would be placed in the Toledo Harbor CDF; sediment dredged lakeward of Lake Mile 2 (approximately 500,000 cubic yards) would be discharged at the proposed open-lake disposal site. Annual maintenance dredging at Toledo Harbor generally begins in the early spring and continues through late fall. In order to avoid interference with fishery spawning activities and migrations, dredging is prohibited in the Maumee River lakeward to Island 18 during the period from 15 February through 15 June. The dredging and discharge operations occur annually and normally would be completed within 150 days.

2.2 Material dredged lakeward of Lake Mile 2 would likely be transported to the open-lake disposal area in hopper dredges or bottom dump scows. After arrival at the disposal site, the vessel would come to a complete stop above the center of the designated disposal area, its bottom gates would be opened, and the dredged material would be allowed to settle to the bottom. At the CDF, pumpout facilities are located at both its northern and northwestern corners and are connected to discharge pipelines which are capable of distributing the material to various locations within the CDF. Although the method of disposal into the CDF would be determined by the Contractor, the most probable method would be pumping through the existing pumpout facilities. In 1989, material would likely be pumped into the eastern sector of the CDF and allowed to settle with the supernatant water allowed to return to Lake Erie through a weir and discharge pipe located at the northern corner of the facility.

2.3 Alternatives to the Proposed Action. Alternatives considered during the preparation of the FEIS for the Toledo Harbor CDF (1974) and FEIS for harbor operations and maintenance (1976) included:

- No dredging;
- Dredging to lesser depths;
- Use of alternative types of dredging equipment;
- Watershed management;
- Open-lake disposal of all dredged material;
- Deep-water (>100 feet) disposal;
- Upland disposal; and
- Pretreatment of dredged material

A detailed discussion of these alternative plans is contained in the FEIS's referenced above.

3. IMPACTS

3.1 Social Impacts.

3.1.1 Noise - Dredging and disposal activities would result in a short-term increase in local noise sources. Noise generated by the action would not exceed ambient noise levels in the harbor area nor would it affect any sensitive noise receptors (e.g.; schools, hospitals).

3.1.2 Aesthetic Values - The presence of dredging equipment would temporarily detract from the aesthetic quality of the Maumee River and Bay. The atmospheric exposure of organic matter which may be contained in the dredged material, would result in a short-term, localized malodor. The resuspension of fine-grained particles in the water column would result in a reduction in clarity and alteration in apparent water color. These effects would be dissipated by local wind patterns and lake currents before impacting upon shoreward areas.

3.1.3 Leisure Opportunities - Dredging and disposal operations may temporarily interfere with recreational boating and fishing activities in the Maumee River and Bay. All dredging equipment would be sufficiently lighted and marked to avoid any significant hindrance of these activities.

3.1.4 Community Growth - The maintenance of a viable commercial harbor at Toledo would preserve the area's potential for desirable community growth.

3.1.5 Health and Safety - The concentration of heavy equipment in the project area during dredging operations could potentially create a hazardous environment. However, standard Corps of Engineers contract specifications require the maintenance of a safe, restricted work area during these periods. The Contractor is required to prepare a detailed job hazard analysis of each major phase of work, including all anticipated hazards and specific actions which would be taken to prevent personal injury. The Contractor is required to comply with Occupational Safety and Health Administration Standards.

3.1.6 Cultural Resources - No historic properties or archaeological sites listed in or eligible for listing in the National Register of Historic Places would be affected by the proposed action.

3.2 Economic Impacts.

3.2.1 Employment/Labor Force - Dredging and disposal activities would result in a short-term increase in employment opportunities, specifically in the marine trades. The maintenance of a functional commercial harbor at Toledo would help to preserve existing employment opportunities associated with shipping and cargo handling.

3.2.2 Business and Industry Activity - The maintenance of Toledo Harbor would assure the economic viability of its dependent commercial activities.

3.2.3 Properties and Tax Revenues - No significant impact.

3.2.4 Public Services and Facilities - Dredging and disposal activities would not affect any public services or facilities. The proposed open-lake disposal area has been sited approximately 2 miles further from the Toledo and Oregon intakes (total distance = 6 miles) in order to allay concerns raised regarding the possible impact of past disposal operations on public water supplies.

3.2.5 Regional Growth - Maintenance of Toledo Harbor would preserve its importance as an inducement for regional growth.

3.3 Environmental Impacts.

3.3.1 Man-Made Resources - The Toledo Harbor CDF currently provides a diverse habitat for shorebirds and waterfowl. Disposal activities would result in its gradual filling and creation of a less diverse upland area.

3.3.2 Natural Resources - Dredging and disposal operations would result in the consumption of an unspecified quantity of fuel.

3.3.3 Air Quality - The operation of dredging equipment would result in an increased output of pollutants (suspended particulates, nitrogen dioxide, carbon monoxide, lead, etc.) into the local atmosphere. This increased output is not expected to result in any long or short-term exceedence violations or interfere with the ability of the Toledo Air Quality Control Region to attain State air quality standards.

3.3.4 Water Quality - Dredging and disposal activities would result in a short-term increase in turbidity levels, in particular at the open-lake disposal site. The turbidity plume, influenced by existing wind patterns and lake currents, would temporarily affect apparent water color and clarity. The effects of the disposal operations on water odor and taste would be negligible in the vicinity of the Toledo and Oregon water intakes.

3.3.5 Due to the normally high oxygen demand associated with fine-grained dredged material, oxygen depletion would generally increase with depth and increasing concentrations of total suspended solids at the disposal site. Due to dilution and settling of the suspended material, dissolved oxygen levels would increase with increasing distance form the disposal area (U.S. Army Corps of Engineers, 1983).

3.3.6 In response to concerns regarding the effects open-lake disposal of dredged material on water quality, monitoring programs were performed during the 1985 and 1986 disposal operations. This program included field measurements of dissolved oxygen, pH and turbidity (secchi depth), and laboratory analysis of water samples for total phosphorus, dissolved phosphorus, suspended solids, and dissolved solids. During each disposal action, dissolved oxygen increased at the dump site with a decrease below the ambient levels away from the dump site. This pattern was attributed to entrainment of air within the mass of dredged material dropped from the bottom of the split-hull dredge. As this material falls to the bottom, it disperses creating a wave of sediment and bottom water which spreads out across the lake bottom. Fine materials rise off the bottom on the turbulence and exert their oxygen demand at a distance away from the dump site.

3.3.7 Turbidity measurements conducted at the disposal site immediately after the dumping operation showed a dramatic decrease in water quality. However, without exception, water clarity returned to pre-dump conditions within 2 hours after the dump. Samples collected before disposal and 2 hours after were analyzed for dissolved phosphorus and total phosphorus. Based on mean concentrations and individual samples, there was no apparent difference between the before and after samples for either total or dissolved phosphorus.

3.3.8 During the spring of 1985, the open-lake disposal operations did not cause any long-term degradation of water quality. Dissolved oxygen concentrations were reduced about 20 percent from what they might have been at that time of the year, but there were no violations of State water quality standards. Turbidity plumes were created, but they did not contain a significant mass of sediment and always were completely dissipated before they could have affected any public water supply intakes. Dissolved phosphorus concentrations may have been increased slightly within the mixing zone, but not to such a degree that the disposal operation could influence the production of algae in the Western Basin of Lake Erie (AquaTech Environmental Consultants, Inc., 1985).

3.3.9 Vegetation - Temporary increases in turbidity and suspended solids generated during dredging and disposal operations may cause minor decreases in primary production and photosynthesis. Reduced light penetration into the water column could have a temporary effect on phytoplankton and photosynthesis at the open-lake disposal area. However, studies conducted at Ashtabula, Ohio, have shown no statistically significant differences in algal populations exist between open-lake disposal sites and unaffected open-lake areas (Sweeney, 1978).

3.3.10 Benthos - Destruction of macroinvertebrates would occur at both disposal sites due to direct burial with dredged material and/or the clogging of gill filaments by suspended sediment particles. After burial with dredged material, some upward movement of surviving benthic organisms would occur. The most significant benthic impacts would occur within the CDF, where all benthic habitat would be ultimately destroyed.

3.3.11 Fish - Temporary adverse impacts on local fish species would occur as a result of short-term increases in turbidity and suspended solid levels. Adult fish would generally exhibit avoidance behavior during dredging and disposal activities and population recovery would be relatively rapid. In order to avoid interference with fishery spawning activities and migrations, dredging is prohibited in the Maumee River lakeward to Island 18 during the period from 15 February through 15 June.

3.3.12 Wildlife - Disruption and disturbance by equipment during dredging and disposal activities would result in a short-term avoidance of the project area by both game and nongame bird species. Although gulls and shorebirds utilize the CDF as a resting, feeding, and nesting area, use of the site by other waterfowl and by other wildlife is relatively limited. The eventual filling of the CDF may cause some alteration in bird utilization of the Toledo waterfront, but should have no noticeable impacts on species diversity in the Toledo area.

In the past, bird deaths associated with botulism outbreaks have occurred at the CDF. Low water levels, high summer temperatures, and an abundance of decaying vegetation and anoxic conditions in the sediments contribute to the growth of naturally occurring bacteria which produce a fatal toxin. In 1989, the Corps of Engineers Waterways Experiment Station will complete a study to develop a management plan to alleviate this problem.

3.3.13 Wetlands - Some wetland vegetation has colonized shallow water areas of the CDF. The presence of this vegetation is a direct result of reduced water depths and the placement of nutrient-rich dredged material within the facility. Additional wetland vegetation would ultimately be destroyed as the area is filled, dewatered, and converted to alternative uses. Although the loss of wetland areas may be significant, the continued filling of the CDF is expected to cause fewer adverse environmental impacts than the construction of an alternative shallow water site or placing highly polluted dredged material in the open lake.

3.3.14 Threatened and Endangered Species - No Federal or State-listed threatened or endangered species or any critical habitat utilized by such species would be affected by the dredging or disposal activities.

4. COMPLIANCE WITH ENVIRONMENTAL PROTECTION STATUTES

4.1 Archaeological and Historic Preservation Act, as Amended (AHPA); National Historic Preservation Act of 1966, as Amended (NHPA); Executive Order 11593 (Protection and Enhancement of the Cultural Environment). Consultation with the National Register of Historic Places has indicated that no known historic properties or archaeological sites listed or eligible for listing in the Register would be affected by the proposed action. For compliance with Section 105 of the NHPA and the AHPA, this EA and FONSI have been submitted to the Advisory Council on Historic Preservation, National Park Service, and Ohio State Historic Preservation Office requesting review and comments.

2.4 Clean Air Act, as Ameneded. Copies of this EA and FONSI have been sent to the Regional Administrator of the U.S. Environmental Protection Agency requesting comments in compliance with the Act.

4.3 Clean Water Act. A Public Notice and Preliminary Evaluation have been prepared for the proposed action pursuant to Section 404 of the Clean Water Act. The Section 404(a) Public Notice was initially released for review on 29 December 1988. In a letter dated 26 January 1989, Dr. Peter C. Fraleigh of the University of Toledo provided comments regarding the adverse effects of the open-lake disposal of dredged material. He stressed the need to evaluate the environmental consequences of resuspension of the dredged material, and presented concerns regarding phosphorus loading in Lake Erie, reduced dissolved oxygen levels in the benthic habitat, and impacts on water quality (Appendix EA-A). Mr. Whit VanCott, Commissioner of Water, City of Toledo noted that the proposed open-lake disposal site is "somewhat better" than last year's site; however, he recommended that only the northeast half of the site be used (9 January 1989).

4.4 The Preliminary Section 404(b)(1) Evaluation is included for review and comment in Appendix EA-B. In accordance with Section 401 of the Act, State Water Quality Certification, or waiver thereof, will be obtained from the Ohio Environmental Protection Agency upon their favorable review of the Evaluation.

4.5 Coastal Zone Management Act of 1972, as Amended. Not applicable.

4.6 Endangered Species Act of 1973, as Amended. The proposed action would not affect any Federal or State-listed or proposed threatened or endangered species or their critical habitat.

4.7 Federal Water Project Recreation Act; Land and Water Conservation Fund Act. In planning the proposed action, full consideration has been given to opportunities afforded outdoor recreation and fish and wildlife enhancement. Review copies of this EA have been provided to the U.S. Department of the Interior in regard to recreation and fish and wildlife activities for conformance with the comprehensive nationwide outdoor recreation plan formulated by the Secretary of the Interior.

4.8 Fish and Wildlife Coordination Act. Copies of this EA and FONSI have been provided to the U.S. Fish and Wildlife Service and Ohio Department of Natural Resources to assure compliance with this Act.

4.9 National Environmental Policy Act. With the circulation of this EA and FONSI, the proposed action is partial compliance with the Act. Full compliance will be attained when the FONSI is signed.

4.10 River and Harbor Act of 1970. The requirements of the Act have been fulfilled by Corps of Engineers planning actions. All 17 points identified in Section 122 of this Act (PL 91-611) have been previously discussed in this EA.

4.11 Executive Order 11988, Flood Plain Management, 24 May 1977. The U.S. Army Corps of Engineers, Buffalo District has concluded that there is no practicable alternative to the proposed action, which would occur within the base flood plain of Lake Erie and that the proposed action is in compliance with this order.

4.12 Executive Order 11990, Protection of Wetlands, 24 May 1977. The U.S. Army Corps of Engineers, Buffalo District has concluded that there is no practicable alternative to the proposed action which would result in the loss of some wetland areas within the Toledo Harbor CDF.

5. AGENCIES/PUBLIC CONTACTED

5.1 Coordination. Copies of this EA have been sent to the following agencies and individuals for review and comment:

Federal

Advisory Council on Historic Preservation
Federal Emergency Management Administration
U.S. Department of Agriculture - Forest Service

Federal (Cont'd)

U.S. Department of Agriculture - Soil Conservation Service
U.S. Department of Commerce - National Oceanic and Atmospheric Administration
U.S. Department of Energy
U.S. Department of Health and Human Services
U.S. Department of Housing and Urban Development
U.S. Department of Interior
U.S. Department of Interior - Fish and Wildlife Service
U.S. Department of Transportation - Coast Guard
U.S. Department of Transportation - Federal Highway Administration
U.S. Environmental Protection Agency

State

Ohio State Clearinghouse:
- Department of Agriculture
- Department of Development
- Department of Development - Division of Energy
- Department of Health
- Department of Natural Resources
- Environmental Protection Agency
- Historic Preservation Office

Local

Toledo Metropolitan Area Council of Governments
Toledo-Lucas County Plan Commissions
Toledo-Lucas County Port Authority
City of Toledo
City of Oregon

Individuals/Organizations

The Center for the Great Lakes
David Dollimore, Ph.D.
Peter C. Fraleigh, Ph.D.
Great Lakes Tomorrow
Lake Carriers' Association
National Wildlife Federation
Ohio Environmental Council
David E. Rathke, Ph.D.
Toledo-Edison Company

OPERATIONS AND MAINTENANCE
TOLEDO HARBOR
LUCAS COUNTY, OHIO

APPENDIX EA-A

CORRESPONDENCE

CITY OF TOLEDO OHIO

DEPARTMENT OF PUBLIC UTILITIES
DIVISION OF WATER
WATER SERVICE BUILDING
401 SOUTH ERIE
TOLEDO, OHIO 43602

PHILIP A. HAWKEY
CITY MANAGER

THOMAS L. KOVACIK
DIRECTOR

WHITFIELD VAN COTT
COMMISSIONER
TELEPHONE: (419) 321-6672

January 9, 1989

Kenneth R. Hallock, P. E.
Acting Commander
Department of the Army
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207-3199

Dear Sir:

I recently received the information that was provided in the Public Notice on the Corps of Engineers 1989 dredging program for the Toledo Harbor. The City of Toledo Water Division has had great concern about the open lake disposal of dredged material and believes that the new dumping site is somewhat better than the previous site. We believe that there are prevailing currents in the lake from the Detroit River which would carry sediment towards our Water Intake Crib. By moving the site further to the north and east, the dredged materials will be further moved from these prevailing currents. I, therefore, request that the site for the dredged dump in the new disposal area, be located on the northeast half of the new disposal area.

The City of Toledo is also concerned about the resuspension of phosphates as it affects our water quality. We, therefore, request that the Corps continue to work in cooperative efforts to eliminate the open lake disposal program in lieu of an upland disposal program.

I appreciate your attention to this matter.

Sincerely yours,

Whit Van Cott

Whit Van Cott
Commissioner of Water

WVC/ps

cc: Philip A. Hawkey, City Manager
Thomas L. Kovacik, Director of Public Utilities
Edwin Hammitt, District Chief - OEPA
Joe Adams, TMACOG
Donald Moline, Commr. ESD
William Butler, Corps of Engineers

The University of Toledo

2801 W. Bancroft Street
Toledo, Ohio 43606

College of Arts and Sciences
Department of Biology
(419) 537-2065

January 26, 1989

Mr. William Butler
Environmental Analysis Branch
Department of the Army
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207-3199

re: Open lake disposal of dredged materials at Toledo Harbor

Dear Mr. Butler:

Thank you for the copy of the Public Notice concerning operation and maintenance dredging at Toledo Harbor, Lucas Co., Ohio. I would like to express my continuing concern regarding the adverse environmental effects of continued open-lake disposal.

Because wind driven erosion, suspension, and resuspension of bottom sediment (hereafter called resuspension) occurs in the Western Basin and because the proposed disposal site appears to be in an area where such resuspension occurs, a need exists to evaluate the environmental consequences of wind driven resuspension of the dredged material. I have been particularly concerned as to whether covering the bottom with dredged material will lead to an increase in sediment resuspension and the problems that result from such resuspension. Logic, to me, suggests that it would. The natural processes at work in such an erosive area, tend to cleanse the area of that sediment which is capable of being resuspended, with this sediment being resuspended, perhaps over and over many times, but with this sediment eventually being transported to depositional areas where it becomes permanently incorporated into the bottom sediments. In addition, the erosive process, at least theoretically, would lower the lake bottom, producing a greater water depth, which would result in a decrease in the ability of wind energy to cause further erosion, thus reducing resuspension. Open-lake disposal seems to work in opposition to these natural processes. Water depth data presented last spring shows that, at least in the short run, open-lake disposal creates a mound at the disposal site, decreasing the water depth which should, all other things being equal, result in increased wind driven resuspension just due to the water being shallower. In addition, it seems illogical that the dredged material (which came from either riverine input or deposition of material resuspended from the lake bottom, or from both) would be similar to lake bottom sediment that was left behind by the cleansing action of wind driven resupension or was not capable of being resuspended by the energy generated by wind action. In the extreme case of the dredged material being from the lake bottom, open-lake disposal involves replacing material that natural processes have just been involved in removing and transporting away. In this regard, I think the results of DePinto's work indicate that the dredged material will, upon resuspension, have a greater adverse effect than would the lake sediments (see my enclosed comments of Jan. 27, 1987). In addition, I have compared the

characteristics of sediments at the proposed site with those of the dredged material (from the early 80s data). This comparison suggests that the clay content of the dredged material is greater than that at the new disposal site and thus there is not a sediment match, and thus resuspension of dredged material will have a greater adverse effect on water quality than resuspension of the background sediments. Since this was based on the early 80s data, I would appreciate your sending me a copy of the more recent data so I can update the comparison (see my request below). Thus, I have been concerned that open-lake disposal will result in greater problems from wind driven resuspension.

In particular, I am concerned that, at some time in the future, the sum of the loading rate from the disposal operation plus the loading rate from resuspension at old disposal sites (of phosphorus and sediment) will become equal to the rate at which these materials are being dredged and released during the disposal operation. This is in contrast to the situation without open-lake disposal where the sediments in these erosive areas gradually become cleansed and eroded such that the loading rate gradually decreases with time, allowing the water quality in the lake to improve. In this persective, the accumulation that has occurred at the previously used disposal site will, in the future, provide a loading that would otherwise have not occurred, if open-lake disposal had not taken place. Only if there is a permanent raising of the bottom level in this area of the lake, will these effects not occur, and I think the evidence suggests that such a permanent emplacement of dredged material is unlikely.

Other continuing concerns I have regard the effect of the dredged material on reducing oxygen levels in the benthic habitat (that I think the data from your 1986 study suggested did happen - see my enclosed comments of Jan. 22, 1987) and the effects of the disposal operation on water quality. In the latter regard, if the material is available to the public, would you please send me a copy of any documentation that you provided the State of Ohio to support your conclusion that the open-lake disposal operation does not violate state water quality standards. Thank you.

Additionally, I look forward to your 404(b)(1) evaluation of the new site. Would you please send me a copy when it becomes available. Also, would you please send me a copy of T. P. Associates International, Inc. "The Analysis of Sediments from Toledo Harbor" Technical Report #I0175-12, June 1988, and of any reports from your bottom characterization study. Thank you.

Also, thank you very much for the efforts you have made, and continue to make, to ensure that the maintenance of Toledo Harbor is carried out in an environmentlly sound fashion. Your work is appreciated.

Sincerely,

Peter C. Fraleigh

Peter C. Fraleigh, Ph.D.
Associate Professor of Biology

DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

REPLY TO
ATTENTION OF

CENCB-PD-ER

DEC 2 9 1988

PUBLIC NOTICE

OPERATION AND MAINTENANCE
TOLEDO HARBOR
LUCAS COUNTY, OHIO

This Public Notice has been prepared and distributed pursuant to Section 404(a) of the Clean Water Act (33 USC 1344). Its purpose is to specify what dredged material would be discharged into waters of the United States by implementation of operations and maintenance dredging at Toledo Harbor. This Notice provides an opportunity for any person who may be affected by such discharge to submit comments or request a public hearing.

The areas considered in this notice are located at a proposed open-lake disposal site and the existing Toledo Harbor Confined Disposal Facility (CDF). The open-lake site is located in Maumee Bay in the western basin of Lake Erie (Figure 1). The Toledo CDF is located immediately southeast of the Federal Navigation Channel at Lake Mile 2, about 355 feet northeast of the Toledo Edison Company's Bayshore Station (Figure 2). The facility borders the Toledo-Lucas County Port Authority and Toledo Edison Company Disposal Areas located immediately to the southwest. The open-lake site is a newly proposed site which has been selected to address public concerns related to past open-lake disposal of dredged material and its impact on public water supplies for the cities of Toledo and Oregon, Ohio.

An estimated 700,000 cubic yards of material would be dredged from Toledo Harbor in 1989, from the Turning Basin at the upstream project limit in the Maumee River to Lake Mile 10. Sediments dredged upstream of Lake Mile 2 (200,000 cubic yards est.) would be placed in the Toledo Harbor CDF; sediments dredged lakeward of Lake Mile 2 (500,000 cubic yards est.) would be discharged at the proposed open-lake disposal site.

Analysis of bottom sediments from the proposed open-lake disposal site was completed in 1987 (T.P. Associates International, Inc., "The Analyses of Sediments from the Proposed Open-Lake Site at Toledo, Ohio," December 1987). This evaluation included particle size analysis, bulk chemical analyses, bioassay testing, and a benthic organism inventory. In 1988, similar testing of bottom sediments collected from the Federal Navigation Channel was completed (T.P. Associates International, Inc., "The Analyses of Sediments from Toledo Harbor," Technical Report #I0175-12, June 1988). Evaluation of these test results indicates that the sediments at both areas have comparable physical, chemical, and biological characteristics and, therefore, the open-lake site would be an acceptable dredged material disposal area.

Consultation with the National Register of Historic Places has concluded that no registered properties, or properties listed as being eligible for inclusion in the Register would be affected by this project. By this Notice, the National Park Service is advised that currently unknown archaeological, scientific, prehistoric, or historic data may be lost or destroyed by the action.

Based on a review of available environmental data and consultation with the U.S. Fish and Wildlife Service and Ohio Department of Natural Resources, it has been determined that the proposed action would not affect any species proposed or designated by the U.S. Department of the Interior as threatened or endangered, nor would it affect the critical habitat of any such species. Therefore, unless additional information indicates otherwise, no further consultation pursuant to Section 7 of the Endangered Species Act Amendments of 1978 will be undertaken with the U.S. Fish and Wildlife Service.

Preliminary assessment of the impacts of the project by the Corps of Engineers concludes that the proposed action would not cause unacceptable disruption to the water quality uses of the affected aquatic ecosystem. The use of the proposed disposal sites will be specified through the application of the Section 404(b)(1) guidelines in accordance with the Clean Water Act. In compliance with the National Environmental Policy Act of 1969, an environmental assessment of the use of the proposed open-lake site will also be completed. These reports will be available for review in February 1989.

By this Public Notice, the Corps of Engineers is requesting that the Ohio Environmental Protection Agency provide Water Quality Certification or a waiver thereof, in accordance with Section 401 of the Clean Water Act.

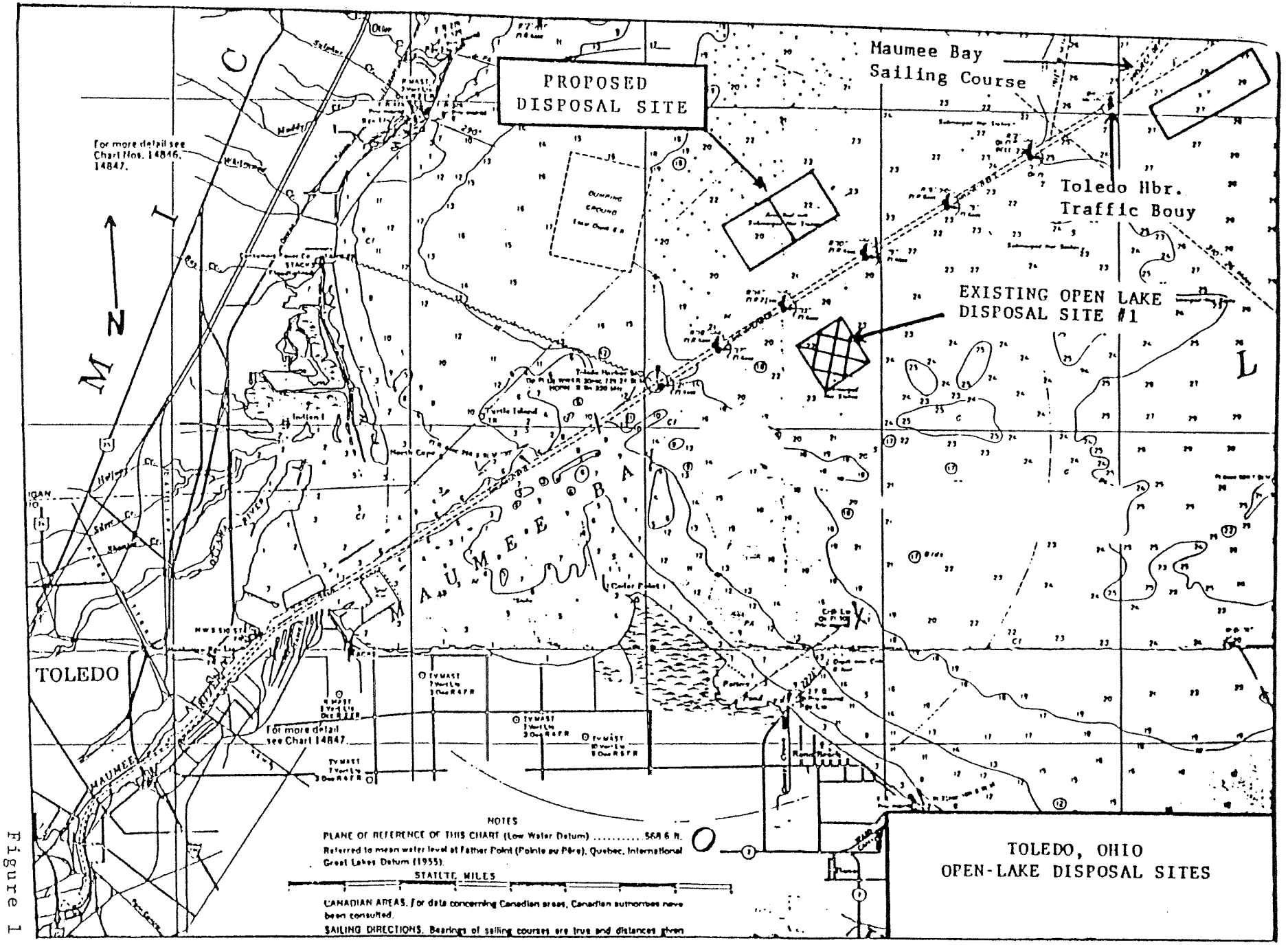
This Notice is being published in conformance with 33 U.S. Code of Federal Regulations 209.145. Any person who has an interest which may be adversely affected by this project may request a public hearing. The request must be submitted in writing to the District Commander within 30 days of the date of this Notice and must clearly set forth the interest which may be affected and the manner in which the interest may affected by this activity.

Any interested parties and/or agencies desiring to express their views concerning the proposed action may do so by filing their comments in writing no later than 4:30 p.m., 30 days from the date of issuance of this Notice. A lack of response will be interpreted as meaning that there is no objection to the proposed action.

My point of contact pertaining to this matter is Mr. William Butler of my Environmental Analysis Branch, who can be contacted by calling 716-876-5454, extension 2175, or by writing to the above address.

Kenneth R Hallock

KENNETH R. HALLOCK, P.E.
Acting Commander


PROPOSED
DISPOSAL SITE
Maumee Bay
Sailing Course
Toledo Hbr.
Traffic Bouy
EXISTING OPEN LAKE
DISPOSAL SITE #1
TOLEDO
For more detail see
Chart Nos. 14846,
14847.
For more detail
see Chart 14847.
NOTES
PLANE OF REFERENCE OF THIS CHART (Low Water Datum) ..... 568.6 ft.
Referred to mean water level at Father Point (Pointe au Père), Quebec, International
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STATUTE MILES
CANADIAN AREAS. For data concerning Canadian areas, Canadian authorities have
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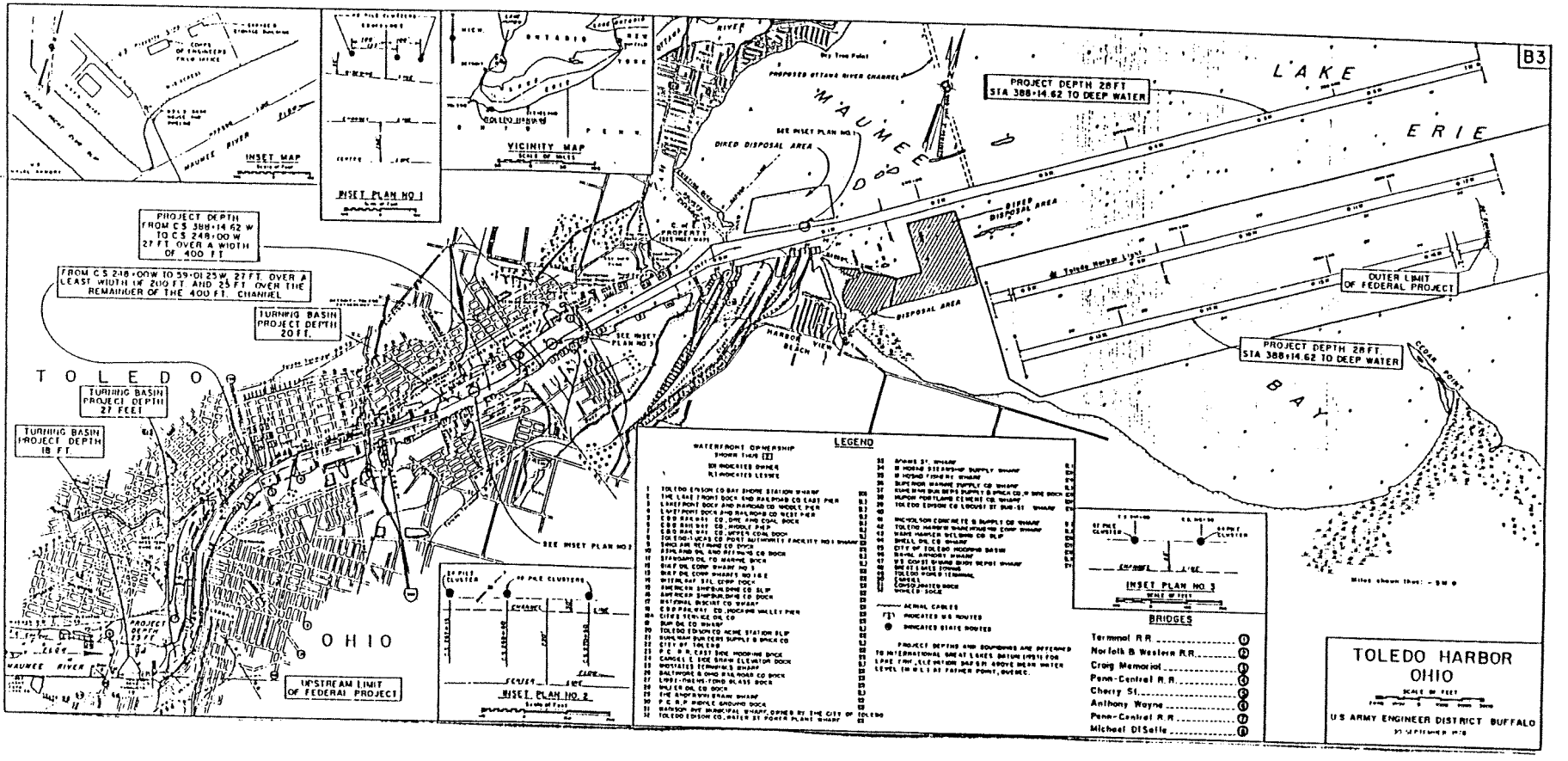
SAILING DIRECTIONS. Bearings of sailing courses are true and distances given
TOLEDO, OHIO
OPEN-LAKE DISPOSAL SITES

Figure 1


B3
TOLEDO HARBOR
OHIO
US ARMY ENGINEER DISTRICT BUFFALO
LAKE ERIE
MAUMEE BAY
TOLEDO
OHIO
PROJECT DEPTH 28FT STA 388+14.62 TO DEEP WATER
PROJECT DEPTH FROM C S 388+14.62 W TO C S 248+00.00 W 27 FT. OVER A WIDTH OF 400 FT.
FROM C S 248+00W TO 59+01.25 W 27 FT. OVER A LEAST WIDTH OF 200 FT AND 25 FT. OVER THE REMAINDER OF THE 400 FT. CHANNEL
TURNING BASIN PROJECT DEPTH 20 FT.
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OUTER LIMIT OF FEDERAL PROJECT
UPSTREAM LIMIT OF FEDERAL PROJECT
DIKED DISPOSAL AREA
DISPOSAL AREA
HARBOR VIEW BEACH
COAST GUARD PROPERTY
PROPOSED OTTAWA RIVER CHANNEL
INSET MAP
INSET PLAN NO 1
VICINITY MAP
INSET PLAN NO 2
INSET PLAN NO 3
LEGEND
WATERFRONT OWNERSHIP SHOWN THUS (1)
(1) INDICATES OWNER
(1) INDICATES LESSEE
AERIAL CABLES
(75) INDICATES U.S. ROUTES
INDICATES STATE ROUTES
PROJECT DEPTHS AND SOUNDINGS ARE REFERRED TO INTERNATIONAL GREAT LAKES DATUM (1955) FOR LAKE ERIE, ELEVATION 569.2 FT. ABOVE MEAN WATER LEVEL IN U.S.L.S.T. FAIRPORT, OHIO.
BRIDGES
Terminal R.R.
Norfolk & Western R.R.
Craig Memorial
Penn-Central R.R.
Cherry St.
Anthony Wayne
Penn-Central R.R.
Michael DiSalle

Figure 2

OPERATIONS AND MAINTENANCE
TOLEDO HARBOR
LUCAS COUNTY, OHIO

APPENDIX EA-B

SECTION 404 PUBLIC NOTICE AND PRELIMINARY EVALUATION

DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

REPLY TO
ATTENTION OF
CENCB-PD-ER

PUBLIC NOTICE FEB 22 1989

OPERATIONS AND MAINTENANCE
TOLEDO HARBOR
LUCAS COUNTY, OH

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The areas considered in this notice are located at a proposed open-lake disposal site and the existing Toledo Harbor Confined Disposal Facility (CDF). The open-lake site is located in the western basin of Lake Erie (Figure 1). The Toledo CDF is located immediately southeast of the Federal Navigation Channel at Lake Mile 2, about 355 feet northeast of the Toledo Edison Company's Bayshore Station (Figure 2). The facility borders the Toledo-Lucas County Port Authority and Toledo Edison Company Disposal Areas located immediately to the southwest. The open-lake site is a newly proposed site which has been selected to address public concerns related to past disposal operations and their impact on public water supplies for the cities of Toledo and Oregon, OH.

An estimated 700,000 cubic yards of material would be dredged from Toledo Harbor in 1989, from the area approximately between River Mile 6 through Lake Mile 10. Sediments dredged upstream of Lake Mile 2 (200,000 cubic yards est.) would be placed in the Toledo Harbor CDF; sediments dredged lakeward of Lake Mile 2 (500,000 cubic yards est.) would be discharged at the proposed open-lake disposal site.

Analysis of bottom sediments from the proposed open-lake disposal site was completed in 1987 (T.P. Associates International, Inc., "The Analyses of Sediments from the Proposed Open-lake Site at Toledo, Ohio," December 1987). This evaluation included particle size analysis, bulk chemical analyses, bioassay testing, and a benthic organism inventory. In 1988, similar testing of bottom sediments collected from the Federal navigation

channel was completed (T.P. Associates International, Inc., "The Analyses of Sediments from Toledo Harbor," Technical Report #I0175-12, June 1988). Evaluation of these test results indicates that the sediments at both areas have comparable physical, chemical, and biological characteristics and therefore the open-lake site would be an acceptable dredged material disposal area.

Consultation with the National Register of Historic Places has concluded that no registered properties, or properties listed as being eligible for inclusion in the Register would be affected by this project. By this Notice, the National Park Service is advised that currently unknown archaeological, scientific, prehistoric, or historic data may be lost or destroyed by the action.

Based on a review of available environmental data and consultation with the U.S. Fish and Wildlife Service and Ohio Department of Natural Resources, it has been determined that the proposed action would not affect any species proposed or designated by the U.S. Department of the Interior as threatened or endangered, nor would it affect the critical habitat of any such species. Therefore, unless additional information indicates otherwise, no further consultation pursuant to Section 7 of the Endangered Species Act Amendments of 1978 will be undertaken with the U.S. Fish and Wildlife Service.

Preliminary assessment of the impacts of the project by the Corps of Engineers concludes that the proposed action would not cause unacceptable disruption to the water quality uses of the affected aquatic ecosystem. The use of the proposed disposal sites will be specified through the application of the Section 404 (b)(1) guidelines in accordance with the Clean Water Act. In compliance with the National Environmental Policy Act of 1969, an environmental assessment of the use of the proposed open-lake site will also be completed. These reports will be available for review in February 1989.

By this Public Notice, the Corps of Engineers is requesting that the Ohio Environmental Protection Agency provide Water Quality Certification or a waiver thereof, in accordance with Section 401 of the Clean Water Act.

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My point of contact pertaining to this matter is Mr. William E. Butler of my Environmental Analysis Branch, who can be contacted by calling telephone number (716) 876-5454, extension 2175 or by writing to the above address.

Hugh F. Boyd III
Colonel, U.S. Army
Commanding

DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

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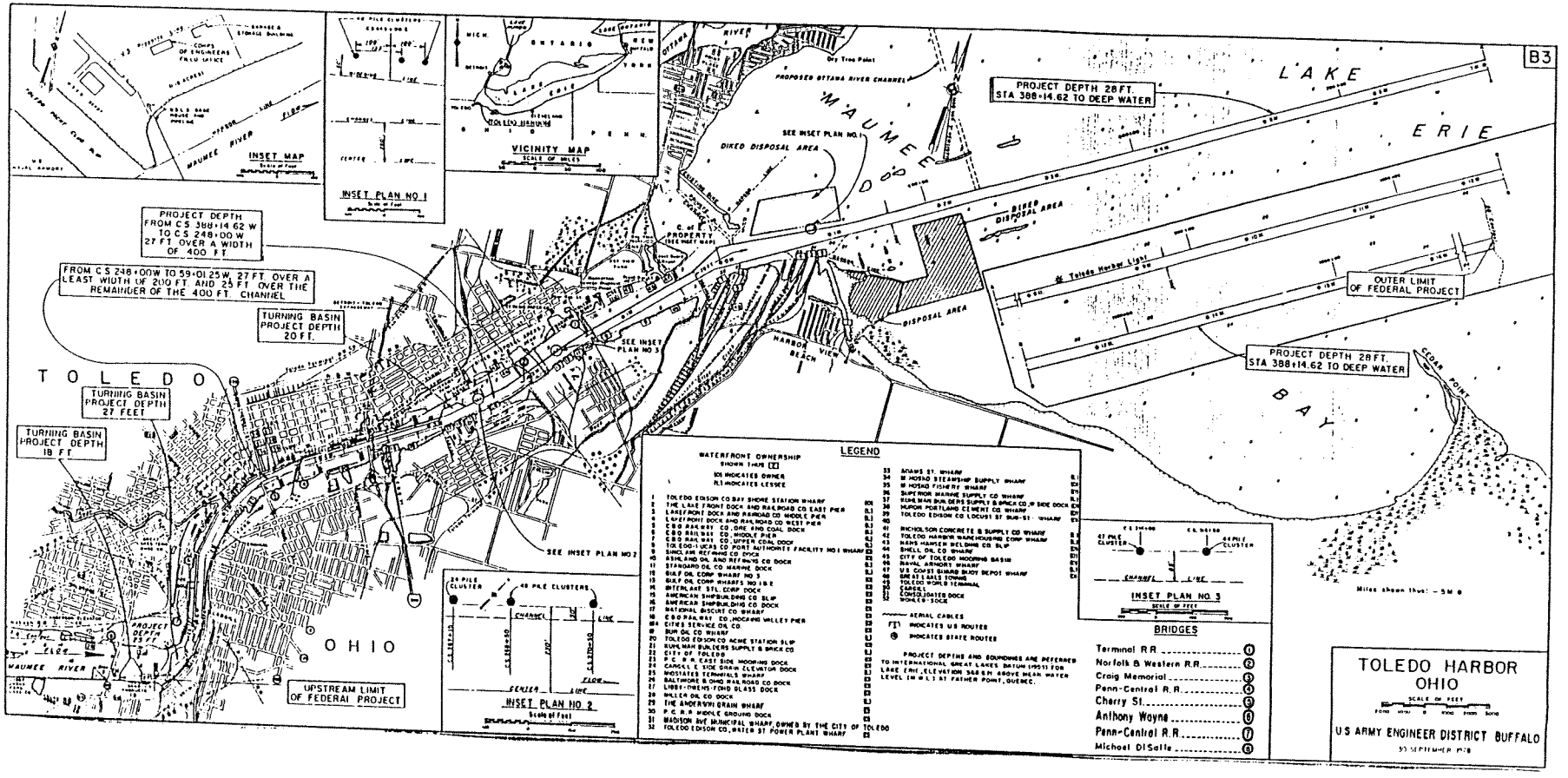
Acting Commander


B3
TOLEDO HARBOR
OHIO
US ARMY ENGINEER DISTRICT BUFFALO
INSET MAP
INSET PLAN NO 1
VICINITY MAP
INSET PLAN NO 2
INSET PLAN NO 3
PROJECT DEPTH FROM CS 388+14.62 W TO CS 248+00 W 27 FT. OVER A WIDTH OF 400 FT.
FROM CS 248+00W TO 59+01.25W, 27 FT. OVER A LEAST WIDTH OF 200 FT. AND 25 FT. OVER THE REMAINDER OF THE 400 FT. CHANNEL
TURNING BASIN PROJECT DEPTH 20 FT.
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DIKED DISPOSAL AREA
DISPOSAL AREA
LAKE ERIE
MAUMEE BAY
TOLEDO
OHIO
MAUMEE RIVER
OTTAWA RIVER
HARBOR BEACH
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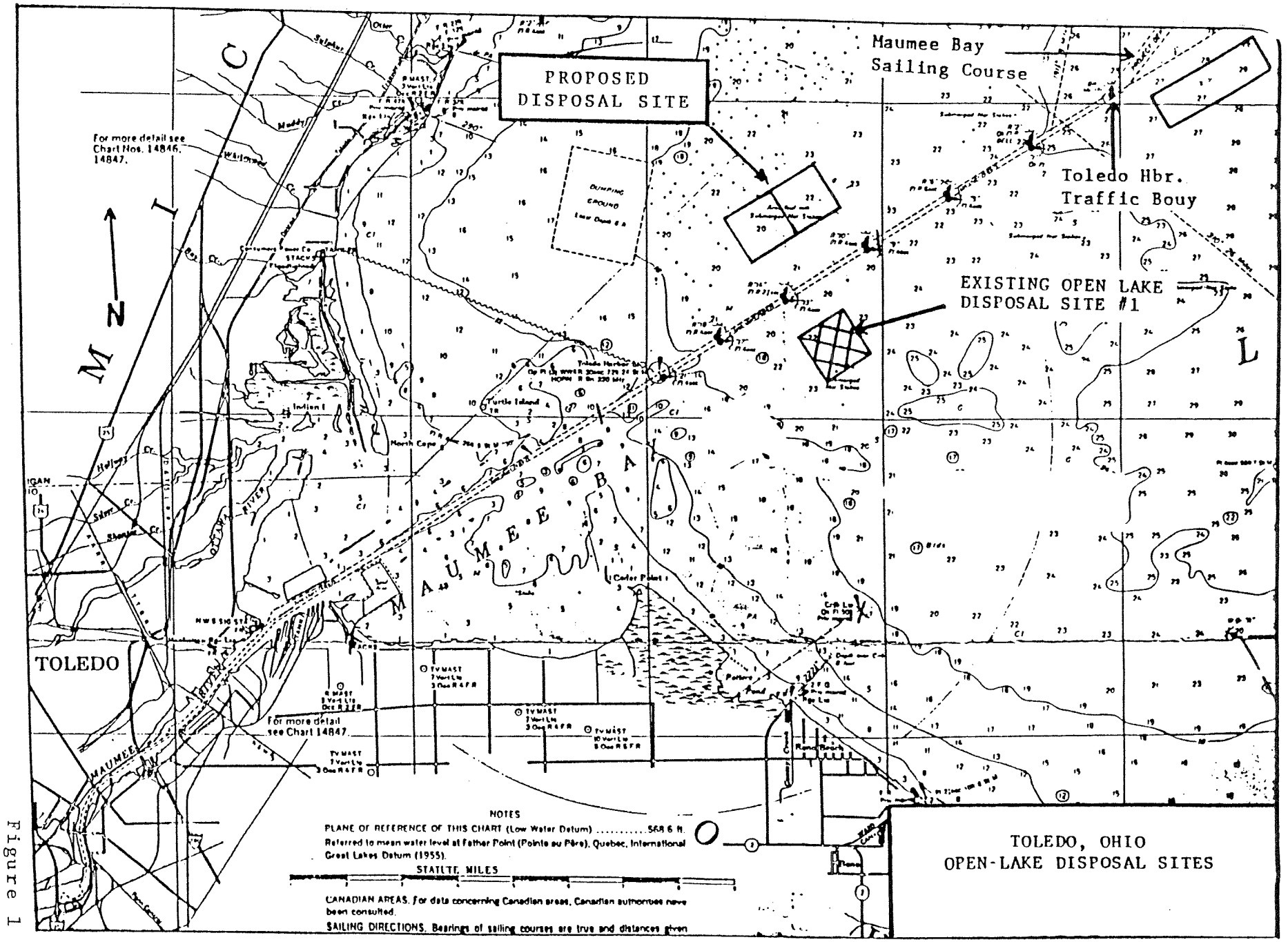
Figure 2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Maumee Bay
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For more detail see
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OPEN-LAKE DISPOSAL SITES

Figure 1

LAB NO. / IDENTIFICATION	4353-88 D-4	4354-88 D-3	4355-88 D-2	4356-88 D-1	4357-88 L-16-M	4358-88 L-15-M	4359-88 L-14-M	4360-88 L-13-M	4361-88 L-12-M	4362-88 L-11-M	4363-88 L-10-M	4364-88 L-9-M	4365-88 L-8-M	4366-88 L-7-M
ARSENIC, TOTAL, AS, MG/KG	18	22	14	15	9	16	13	9	19	18	21	17	14	16
BARIUM, TOTAL, BA, MG/KG	67	79	87	60	29	49	42	31	60	60	69	53	67	74
CADMIUM, TOTAL, CD, MG/KG	1	3	3	2	2	3	3	2	3	2	2	2	2	0.9
CHROMIUM, TOTAL, CR, MG/KG	25	48	78	25	32	49	38	28	37	31	30	19	21	18
COD, MG/KG	51000	110000	96000	57000	34000	72000	53000	38000	76000	74000	93000	67000	63000	76000
COPPER, TOTAL, CU, MG/KG	31	54	58	37	32	50	39	30	44	43	41	31	29	28
CYANIDE, TOTAL, CN, MG/KG	<0.5	<0.6	<0.7	<0.4	<0.3	<0.5	<0.5	<0.4	0.69	0.35	0.75	0.4	0.23	0.52
IRON, TOTAL, FE, MG/KG	20300	26000	25500	19300	12600	17700	14700	11300	22300	17600	23300	15300	18000	20300
LEAD, TOTAL, PB, MG/KG	29	57	69	35	40	67	45	34	59	48	38	23	33	25
MANGANESE, TOTAL, MN, MG/KG	400	440	500	360	280	400	350	255	400	400	440	450	360	440
MERCURY, TOTAL, HG, MG/KG	0.1	0.6	0.5	0.2	0.3	0.7	0.5	0.3	0.4	0.3	0.3	0.3	0.2	0.1
NICKEL, TOTAL, NI, MG/KG	29	52	56	33	30	49	39	32	42	38	39	28	25	29
NITRATE N, MG/KG	<7	<12	<12	<9	<6	<9	<9	<7	<11	<11	<13	<10	<7	<10
NITROGEN, AMMONIA, N, MG/KG	87	89	96	120	21	50	42	37	93	110	170	81	59	120
OIL/GREASE, MG/KG	270	400	650	320	880	830	520	250	650	460	590	4300	620	420
PHENOLS, 4-AAP, MG/KG	0.23	0.24	0.25	0.14	0.26	0.13	0.14	0.16	0.28	0.20	0.20	0.18	0.10	0.19
PHOSPHORUS, TOTAL, P, MG/KG	870	890	1100	780	570	830	710	560	760	780	750	700	760	750
RESIDUE, T. VOLATILE, %	4.50	6.60	5.57	2.32	2.51	5.12	4.81	3.23	4.67	4.89	6.51	4.77	3.88	5.52
RESIDUE, TOTAL (TS), %	48.3	33.2	31.0	42.2	59.4	38.5	42.2	54.0	35.0	36.3	30.0	38.2	48.8	39.3
TOTAL KJELDAHL N, MG/KG	1320	1330	1470	1080	472	952	852	649	1050	1440	1470	1300	1060	1270
ZINC, TOTAL, ZN, MG/KG	110	210	230	130	130	200	160	110	160	160	150	100	100	100

LAB NO. / IDENTIFICATION	4367-88 L-6-M	4368-88 L-5-M	4369-88 L-4-M	4370-88 L-3-M	4371-88 L-2-M	4372-88 L-1-M	4373-88 O-M	4374-88 R-1-M	4375-88 R-2-M	4376-88 R-3-M	4377-88 R-4-M	4378-88 R-5-M	4379-88 R-6-M	4380-88 R-7-M
ARSENIC, TOTAL, AS, MG/KG	16	15	20	18	20	22	20	21	22	23	12	22	18	16
BARIUM, TOTAL, BA, MG/KG	76	72	90	82	92	110	100	120	120	120	70	110	82	65
CADMIUM, TOTAL, CD, MG/KG	1	1	1	1	2	2	2	2	2	2	2	1	0.9	2
CHROMIUM, TOTAL, CR, MG/KG	19	18	20	17	23	24	31	57	39	24	14	20	16	13
COD, MG/KG	76000	72000	82000	74000	86000	97000	83000	120000	84000	87000	46000	82000	58000	61000
COPPER, TOTAL, CU, MG/KG	27	29	32	29	33	37	38	52	39	36	27	40	26	23
CYANIDE, TOTAL, CN, MG/KG	0.6	0.56	0.48	0.47	0.7	1.5	0.52	1.58	0.67	0.98	<0.3	0.5	<0.6	<0.3
IRON, TOTAL, FE, MG/KG	18900	14400	23100	16000	22900	24900	27200	31500	29000	30600	13900	24500	19900	13200
LEAD, TOTAL, PB, MG/KG	24	24	23	23	29	26	34	52	29	32	23	41	19	16
MANGANESE, TOTAL, MN, MG/KG	360	370	400	355	470	460	390	420	530	470	320	440	340	335
MERCURY, TOTAL, HG, MG/KG	0.3	0.1	0.1	0.3	0.1	0.1	0.2	0.4	0.2	0.1	0.2	0.2	0.1	0.2
NICKEL, TOTAL, NI, MG/KG	25	23	27	24	30	32	33	46	33	31	19	27	23	23
NITRATE N, MG/KG	<9	<8	<10	<9	<10	<9	<9	<10	<10	<10	<6	<9	<7	<8
NITROGEN, AMMONIA, N, MG/KG	160	140	110	160	200	180	270	870	210	150	88	150	91	89
OIL/GREASE, MG/KG	330	30	340	380	680	900	1300	3900	1100	710	340	980	270	430
PHENOLS, 4-AAP, MG/KG	0.23	0.13	0.20	<0.10	0.39	0.23	0.21	0.69	0.29	0.16	0.13	0.17	0.13	0.12
PHOSPHORUS, TOTAL, P, MG/KG	770	830	840	900	980	1100	1200	3500	1400	1100	840	1100	820	735
RESIDUE, T. VOLATILE, %	5.58	6.11	5.98	4.83	7.16	7.58	6.63	8.84	7.45	7.29	4.29	10.0	4.25	7.47
RESIDUE, TOTAL (TS), %	44.4	46.2	38.9	43.3	36.9	37.6	42.3	36.8	37.0	37.6	54.7	41.5	46.6	47.6
TOTAL KJELDAHL N, MG/KG	1460	1450	1500	1810	1420	1870	1700	2620	1630	2860	1630	2750	1690	1980
ZINC, TOTAL, ZN, MG/KG	95	100	110	98	120	150	140	330	170	160	93	150	97	82

LAB NO. / IDENTIFICATION	7792-87 D-1	7793-87 D-2	7794-87 D-3	7795-87 R-1	7796-87 D-4
ARSENIC, TOTAL, AS	8	4	6	9	4
BARIUM, TOTAL, BA	76	33	47	62	31
CADMIUM, TOTAL, CD	2	1	2	2	1
CHROMIUM, TOTAL, CR	36	14	25	31	13
COD	120000	53000	44000	65000	58000
COPPER, TOTAL, CU	47	17	30	40	16
CYANIDE, TOTAL, CN	<0.76	<0.42	<0.51	0.54	<0.37
IRON, TOTAL, FE	7600	7500	7900	7800	7800
LEAD, TOTAL, PB	53	19	34	44	21
MANGANESE, TOTAL, MN	400	180	260	340	170
MERCURY, TOTAL, HG	0.75	0.12	0.37	0.64	0.13
NICKEL, TOTAL, NI	42	18	27	35	16
NITRATE N	<3	1	<2	<2	<2
NITROGEN, AMMONIA, N	86	37	46	60	31
OIL/GREASE	1100	432	969	856	444
PHENOLS, 4-AAP	<0.152	<0.086	<0.097	<0.124	<0.055
PHOSPHORUS, TOTAL, P	6060	2200	1820	1750	2190
RESIDUE, T. VOLATILE, %	7.29	2.64	3.71	4.26	2.53
RESIDUE, TOTAL (TS), %	32.0	55.8	48.0	41.2	63.6
TOTAL KJELDAHL N	3660	869	1310	1970	966
ZINC, TOTAL, ZN	180	71	130	160	69

LAB NO. / IDENTIFICATION	7797-87 D-8	7798-87 D-7	7798-87 D-6	7800-87 D-5
ARSENIC, TOTAL, AS	14	8	9	7
BARIUM, TOTAL, BA	80	47	70	55
CADMIUM, TOTAL, CD	2	2	2	1
CHROMIUM, TOTAL, CR	34	21	32	30
COD	85000	63000	71000	59000
COPPER, TOTAL, CU	47	28	43	38
CYANIDE, TOTAL, CN	<0.58	<0.53	<0.64	<0.46
IRON, TOTAL, FE	7500	7800	7600	15000
LEAD, TOTAL, PB	49	62	52	46
MANGANESE, TOTAL, MN	400	240	350	140
MERCURY, TOTAL, HG	0.99	0.58	0.97	1.11
NICKEL, TOTAL, NI	43	24	39	34
NITRATE N	<3	<2	<2	<2
NITROGEN, AMMONIA, N	91	62	59	46
OIL/GREASE	828	487	873	967
PHENOLS, 4-AAP	<0.139	<0.108	<0.111	<0.108
PHOSPHORUS, TOTAL, P	2720	1670	1740	1980
RESIDUE, T. VOLATILE, %	5.97	4.23	5.79	5.9
RESIDUE, TOTAL (TS), %	33.7	41.4	36.3	44.5
TOTAL KJELDAHL N	2890	1670	2020	2100
ZINC, TOTAL, ZN	170	110	160	160

Above data, except as noted, reported as mg/kg (dry wt. basis).

LAB NO. IDENTIFICATION	4778-88 D-4	4779-88 D-3	4780-88 D-2	4781-88 D-1	4782-88 L-16-M	4783-88 L-15-M	4784-88 L-14-M	4785-88 L-13-M	4786-88 L-13-M RPT.	4787-88 BLANK	4788-88 L-12-M	4789-88 L-11-M	4790-88 L-10-M	4791-88 L-9-M	4792-88 L-8-M	4793-88 L-7-M
ARSENIC, TOTAL, AS, UG/L	8	<5	<5	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	5
BARIUM, TOTAL, BA, UG/L	170	200	170	180	180	170	190	190	170	170	54	150	180	190	190	240
CADMIUM, TOTAL, CD, UG/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
CHROMIUM, TOTAL, CR, UG/L	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	31	30
COPPER, TOTAL, CU, UG/L	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
CYANIDE, TOTAL, CN, MG/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
IRON, TOTAL, FE, UG/L	160	200	220	220	160	310	280	130	160	56	77	85	110	110	85	150
LEAD, TOTAL, PB, UG/L	<5	<5	<5	<5	<5	<5	6	<5	<5	<5	<5	<5	<5	<5	<5	<5
MANGANESE, TOTAL, MN, UG/L	420	540	660	640	470	540	720	530	600	91	99	360	1000	590	450	1200
MERCURY, TOTAL, HG, UG/L	<2.0	2.0	<2.0	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	<2.0	<2.0	3.0	<2.0	2.0	2.0
NICKEL, TOTAL, NI, UG/L	<30	<30	<30	37	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
NITRATE N, MG/L	0.14	0.11	<0.08	<0.08	0.11	<0.08	<0.08	<0.08	<0.08	<0.08	0.14	<0.08	<0.08	<0.08	<0.08	<0.08
NITROGEN, AMMONIA, N, MG/L	2.53	1.98	1.68	4.11	1.33	1.80	1.50	1.59	1.57	<0.02	2.21	3.25	5.11	2.93	1.77	5.92
OIL/GREASE, MG/L	24	1	5	<1	1	<1	1	2	2	<1	<1	1	2	<1	3	<1
PHENOLS, 4-AAP, MG/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	0.01	<0.01	<0.01
PHOSPHORUS, TOTAL, P, MG/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
TOTAL KJELDAHL N, MG/L	3.00	2.04	1.71	4.22	1.50	1.81	1.90	1.78	1.63	<0.10	2.56	3.76	5.54	3.23	1.89	7.02
ZINC, TOTAL, ZN, UG/L	55	47	41	40	35	33	42	35	29	<20	<20	25	41	34	23	53

LAB NO. IDENTIFICATION	4794-88 L-6-M	4795-88 L-5-M	4796-88 L-4-M	4797-88 L-3-M	4798-88 L-3-M RPT.	4799-88 L-2-M	4800-88 L-1-M	4801-88 O-M	4802-88 R-1-M	4803-88 R-2-M	4804-88 R-3-M	4805-88 R-4-M	4806-88 R-5-M	4807-88 R-6-M	4808-88 R-7-M	4809-88 R-7-M RPT.
ARSENIC, TOTAL, AS, UG/L	<5	5	11	6	7	7	8	5	8	11	11	14	18	12	16	12
BARIUM, TOTAL, BA, UG/L	180	180	190	190	250	170	190	190	230	150	180	200	200	140	190	190
CADMIUM, TOTAL, CD, UG/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
CHROMIUM, TOTAL, CR, UG/L	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
COPPER, TOTAL, CU, UG/L	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
CYANIDE, TOTAL, CN, MG/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
IRON, TOTAL, FE, UG/L	130	130	140	110	120	250	400	110	450	110	230	110	100	92	180	110
LEAD, TOTAL, PB, UG/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
MANGANESE, TOTAL, MN, UG/L	980	390	1300	1100	1100	1400	1400	410	690	580	1200	830	640	670	1000	1100
MERCURY, TOTAL, HG, UG/L	<2.0	4.0	<2.0	<2.0	<2.0	11.0	3.0	<2.0	<2.0	<2.0	<2.0	22	4.0	3.0	<2.0	<2.0
NICKEL, TOTAL, NI, UG/L	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
NITRATE N, MG/L	<0.08	0.18	<0.08	0.11	0.11	<0.08	<0.08	0.43	<0.08	0.36	0.14	0.39	0.29	0.32	0.11	0.18
NITROGEN, AMMONIA, N, MG/L	8.33	6.55	6.11	6.80	7.44	8.38	8.02	8.03	27.5	6.70	6.37	4.04	5.14	3.49	4.41	4.10
OIL/GREASE, MG/L	8	<1	<1	1	<1	1	<1	<1	4	4	<1	<1	1	<1	1	<1
PHENOLS, 4-AAP, MG/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PHOSPHORUS, TOTAL, P, MG/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	0.18	0.23	<0.10	0.11	<0.10
TOTAL KJELDAHL N, MG/L	8.79	6.74	6.20	7.56	8.30	8.80	8.60	8.50	30.6	7.20	6.60	4.80	5.40	3.70	5.30	5.00
ZINC, TOTAL, ZN, UG/L	41	37	54	46	61	34	37	41	51	27	29	44	52	28	46	47

PRELIMINARY
SECTION 404(b)(1) EVALUATION
OPERATIONS AND MAINTENANCE
TOLEDO HARBOR
LUCAS COUNTY,OH

1. PROJECT DESCRIPTION

1.1 Location. Toledo Harbor is located in Lucas County, OH, at the western end of Lake Erie about 110 miles west of Cleveland, OH, and 40 miles south of Detroit, MI.

1.2 General Description. The Federal project at Toledo Harbor consists of:

a. Channel 28 feet deep and 500 feet wide from deep water in Lake Erie at the mouth of the Maumee River, a distance of approximately 18 miles.

b. Widening 38.6 acres opposite the Chesapeake and Ohio and Lake Front Terminal docks.

c. Channel in the Maumee River 27 feet deep and 400 feet wide from River Mile 0 to River Mile 3; thence a channel 400 feet wide from River Mile 3 to River Mile 6.5 with depths of 27 feet over a least width of 200 feet, and 25 feet over the remainder of the 400-foot channel width; thence a channel 25 feet deep and 200 feet wide top the upper limit of the project (River Mile 7).

d. Turning Basin opposite American Shipbuilding docks (River Mile 2.7) 750 feet wide, 800 feet wide, and 20 feet deep.

e. Turning Basin just upstream from the old Fassett Street bridge (River Mile 6.5), semicircular in shape with a radius of 730 feet, 27 feet deep.

f. Turning Basin 18 feet deep and 8.25 acres in the area at the upper project limit.

g. Clearing of the Sailing Course between Maumee Bay Channel and East Outer Channel, Detroit River to a depth of 28 feet over a width of 1,200 feet.

1.3 Authority and Purpose. The existing project was authorized by the 1899, 1910, 1935, 1950, 1954, 1958, and 1960 River and Harbor Acts to provide for commercial navigation in Toledo Harbor. Annual maintenance dredging is conducted to remove sediments deposited by the Maumee River in the Toledo Harbor Federal navigation channel.

1.4 General Description of Dredged and Fill Material.

1.4.1 General Characteristics of Material. Toledo Harbor sediments consist primarily of fine-grained silts and cla Particle size analysis of the sediments indicated approximately 87.0 percent of the material from Lake Mile 3 through Lake Mile 16 passed through the #200 sieve; approximately 87.1 percent of the material from River Mile 7 through Lake Mile 2 passed through the #200 sieve (T.P. Associates International, Inc., 1988)

1.4.2 Quantity of Material. An estimated 700,000 cubic yards of material would be dredged from Toledo Harbor in 1989. About 200,000 cubic yards of material classified as polluted would be placed in the existing Toledo Harbor Confined Disposal Facility (CDF). Approximately 500,000 cubic yards of unpolluted material would be placed at the proposed open-lake disposal site.

1.4.3 Source of Material. Sediments would be dredged from the Federal navigation channel at Toledo Harbor. The ultimate source of this material is erosion and surface runoff throughout the Maumee River Basin. Primary sources of contaminants in the Maumee River and its sediments are agricultural runoff, discharges from municipal sewage treatment plants, combined sewer overflows, and 48 point sources - nine municipal and 39 industrial (The Center for the Great Lakes, 1988).

1.5 Description of the Proposed Discharge Sites.

1.5.1 Location. The proposed open-lake disposal site is located in the western basin of Lake Erie (Figure 1). The center of the site is located on an azimuth of 33° at a distance of 3.5 miles from the Toledo Harbor Light. In response to a recommendation by the City of Toledo - Division of Water (9 January 1989), only the northeast half of the designated site would be utilized. The Toledo Harbor CDF is located immediately southeast of the Federal Navigation Channel at Lake Mile 2, about 355 feet northeast of the Toledo Edison Company's Bayshore Station. The facility borders the Toledo-Lucas County Port Authority and Toledo Edison Company Disposal Areas located immediately to the southwest (Figure 2).

1.5.2 Size. The proposed open-lake disposal area encompasses two square miles; the interior of the CDF covers about 220 acres.

1.5.3 Type of Site. The open-lake disposal site is unconfined; the CDF is a confined site.

1.5.4 Type of Habitat. The proposed open-lake disposal site consists of lake bottom habitat with average depths of 20-23 feet below LWD. The Toledo Harbor CDF is partially filled, containing a large delta of dredged material. Aquatic vegetation currently exists in some portions of the site.

1.5.5 Timing and Duration of Discharge. The timing and

duration of the disposal operations would in part be controlled by the Corps of Engineers' Contractor and the limitations of their dredging and disposal equipment, and workload. Annual maintenance dredging at Toledo Harbor generally begins in the early spring and continues through late fall. In order to avoid interference with fishery spawning activities and migrations, dredging is prohibited in the Maumee River lakeward to Island 18 during the period from 15 February through 15 June. The dredging and discharge operations would be completed within 150 days.

1.6 Description of Discharge Method. Dredged material would likely be transported to the open-lake disposal area in hopper dredges or bottom dump scows. After arrival at the disposal site, the vessel would come to a stop, its bottom gates would be opened, and the dredged material would be allowed to settle to the bottom. Pumpout facilities are located at both the northern and northwestern corners of the Toledo Harbor CDF. Pumpout facilities are connected to discharge pipelines which are capable of distributing the material to several locations within the CDF. Although the method of disposal into the CDF would be determined by the Contractor, the most probable method would be pumping through the existing pumpout facilities. Material would likely be pumped into the eastern sector of the CDF, allowed to settle, and the supernatant water returned to Lake Erie through a weir and discharge pipe located at the northern corner of the facility.

2. FACTUAL DETERMINATIONS

2.1 Physical Substrate Determinations.

2.1.1 Substrate Elevation and Slope. The disposal of dredged material at the proposed open-lake site would eventually raise bottom elevations at the site. Bottom irregularities would tend to be leveled by lake currents. Within the CDF, all bottom elevations would eventually raised to the elevation of the top of the dike walls, 23.5 feet above LWD.

2.1.2 Sediment Type. Bottom sediments at the proposed open-lake disposal site consist primarily of silts and clays. Particle size analysis of these sediments indicated that from 45.3 to 96.4 percent of the material passed through the #200 sieve (T.P. Associates International, Inc., 1987). Particle size analysis of the harbor sediments indicated that from 61.1 to 98.0 percent of the material passed through the #200 sieve and therefore are also classified as predominantly silts and clays (T.P. Associates International, Inc., 1988). Therefore, no significant change in sediment type at the disposal site is anticipated as a result of the disposal activities. Since the Toledo Harbor CDF has been historically used as a fill site for harbor sediments, no significant changes in sediment types would occur.

2.1.3 Fill Material Movement. Any movement of dredged material at the CDF would be confined to the interior of the diked area. During discharge operations, the CDF would serve as a settling basin for the deposition of suspended sediments. As the area is filled, dredged material would spread throughout the containment area. Further settling would occur as the material is allowed to consolidate. Since the proposed open-lake site is unconfined, any dredged material placed there would be subjected to the forces of Lake Erie currents. Monitoring of the open-lake disposal program conducted in 1986 indicated that approximately 70 percent of the sediments remained within the open-lake disposal site (AquaTech Environmental Consultants, Inc., 1986).

2.1.4 Physical Effects on Benthos. Destruction of macroinvertebrates would occur at both sites due burial with dredged material and/or the clogging of gill filaments by suspended sediment particles. A benthic survey of the open-lake site indicated a predominant faunal assemblage of chironomids and oligochaetes and a somewhat limited species diversity (T.P. Associates International, Inc., 1987). After burial with dredged material, some upward movement of surviving benthic organisms would occur. At the open-lake site, relatively rapid recolonization by nearby surviving organisms would occur. The most significant benthic impacts would occur within the CDF, where all benthic habitat would be ultimately destroyed.

2.1.5 Other Effects. Some compaction of the existing substrate would occur at both discharge sites.

2.1.6 Actions Taken to Minimize Impacts. The proposed open-lake disposal site has been selected since it has depths adequate to receive harbor dredgings without adversely affecting substrate elevation and slope. The particle size characteristics of the bottom sediments at the open-lake site are comparable to those of the harbor sediments; therefore, alterations in sediment type would not occur. The Contractor would be required to stop the discharge vessel above the center of the disposal area in order to minimize the lateral movement of material from the site.

2.2 Water Circulation, Fluctuation, and Salinity Determinations.

2.2.1 Water:

a. Salinity - Not applicable.

b. Water Chemistry - No significant alterations in pH are expected at either disposal site.

c. Clarity - Disposal activities would result in a short-term increase in turbidity levels. Any turbidity at the open-lake site would be influenced by existing wind patterns and lake

currents. No significant adverse impacts are anticipated overall and no long-term impacts are expected.

d. Color - The suspension of fine-grained particles in the water column during disposal operations would temporarily alter water color. At the CDF, this impact would be restricted to water areas inside the dike walls. Water color alterations at the open-lake site would be controlled by lake currents and wind conditions during the disposal period.

e. Odor - The atmospheric exposure of organic matter which may be contained in the dredged material would result in a short-term, localized malodor.

f. Taste - The suspension of particulates in the water column would temporarily adversely affect the taste of water in the vicinity of the open-lake site. However, since this site was selected due to its distance from the Toledo and Oregon municipal water intakes, no significant adverse impacts on public water supplies are anticipated.

g. Dissolved Gas Levels - Due to the normally high oxygen demand associated with fine-grained dredged material, some oxygen depletion may occur at the open-lake disposal site. Detailed monitoring of open-lake disposal of dredged material at Toledo in 1985 showed that dissolved oxygen concentrations were reduced about 20 percent, but nevertheless no violations of State water quality standards occurred. The degree of oxygen depletion would generally increase with depth and increasing concentrations of total suspended solids. Due to dilution and settling of the suspended material, dissolved oxygen levels would increase with increasing distance from the discharge point (U.S. Army Corps of Engineers, 1983).

h. Nutrients - Bulk chemical analyses of bottom sediments sampled from the open-lake disposal site and from Toledo Harbor indicated both areas have similar levels of nutrient content (i.e., nitrate-nitrogen, ammonia-nitrogen, and total phosporus). Elutriate testing of the harbor sediments indicated no releases of phosphorus or nitrate-nitrogen above State water quality standards (T.P. Associates International, Inc., 1987 and 1988; Ohio Environmental Protection Agency, 1987). It has been estimated that in a typical dredging operation 20-30 metric tons (MT) of available phosphorus would be contributed to the western basin which represents only 0.43-0.63 percent of the 1980 available basin phosphorus load (De Pinto, 1986).

i. Eutrophication - No significant effect.

2.2.2 Current Patterns and Circulation:

a. Current Pattern and Flow - A very limited amount of wind-

generated water circulation occurs within the CDF. Although excess water does filter through the dike walls and passes through the overflow weir to Maumee Bay, the quantity of water would be relatively minor in comparison to the total volume of water in the vicinity. Due to existing and anticipated depths at the open-lake site, no significant impacts on current patterns or flows are anticipated.

b. Velocity - No effect.

c. Stratification - No effect.

d. Hydrologic Regime - No effect.

2.2.3 Normal Water Level Fluctuations. No effect.

2.2.4 Salinity Gradients. Not applicable.

2.2.5 Actions Taken to Minimize Impacts. To minimize adverse impacts on public water supply intakes possibly resulting from past open-lake disposal operations, the proposed open-lake disposal site has been sited two miles north of the previous site. Only those sediments which have been classified as "unpolluted" would be discharged at the open-lake site thereby minimizing adverse impacts on water chemistry and local nutrient levels. Water depth at the site would be sufficient to accept dredged material without interfering with current patterns and circulation, or normal water level fluctuations.

2.3 Suspended Particulate/Turbidity Determinations.

2.3.1 Expected Changes in Suspended Particulates and Turbidity in the Vicinity of the Discharge Sites. Dredging and disposal activities expected to increase local turbidity during the actual work period. Due to shallow depths, average turbidity levels in Maumee Bay are quite high. Wind-induced resuspension of sediments in the western basin of Lake Erie range from 50-100 MT/km^2-yr. Even using the lower estimate, this converts to an annual bottom sediment resuspension of 150,000,000 MT/yr, an amount more than 500 times the typical annual open-lake dredged material disposal operation (DePinto, 1986). Elevated suspended solids concentrations resulting from the scheduled maintenance activities would be confined to the immediate vicinity of the dredge or discharge point and would dissipate rapidly upon completion of the operation (U.S. Army Corps of Engineers, 1983) No violations of State water quality standards are anticipated.

2.3.2 Effects on Chemical and Physical Properties of the Water Column:

a. Light Penetration - Dredging and disposal activities and resultant turbidity increases would temporarily decrease light

penetration at the disposal sites.

b. Dissolved Oxygen - Due to the normally high oxygen demand associated with fine-grained dredged material, oxygen depletion may occur at the open-lake disposal site as discussed in paragraph 2.2.1. The degree of oxygen depletion would generally increase with depth and increasing concentrations of total suspended solids. However, dissolved oxygen levels would increase with increasing distance from the discharge point, due to dilution and settling of the suspended material (U.S. Army Corps of Engineers, 1983).

c. Toxic Metals and Organics - Elutriate testing of Toledo Harbor sediments conducted in 1988 indicated releases of manganese, mercury, and zinc above State water quality standards from all sampling sites within the proposed dredging area. Standards are not expected to be exceeded beyond the allowable mixing zone. No volatile halocarbons, organochlorine pesticides, or polychlorinated biphenyls were detected at any of the sampling locations. Total polyaromatic hydrocarbons (PAH's) were found at their highest levels at river sampling sites and Station L-1 (2.4 to 13.5 $\mu g/g$), PAH levels at L-2 and L-3 were 1.86 and 1.84 $\mu g/g$, respectively. Total PAH's at L-4 to L-7 ranged from 0.44 to 0.68 $\mu g/g$, L-8 was 1.15 $\mu g/g$, and L-9 to L-16 ranged from <0.30 to 0.42 $\mu g/g$ (T.P. Associates International, Inc., 1988). Sediments to be disposed at the open-lake site are classified as "nonpolluted" to "moderately polluted" based on U.S. Environmental Protection Agency - Region V criteria (Table 3).

d. Pathogens - No effect.

e. Aesthetics - Increased turbidity in the project area would temporarily detract from local aesthetic qualities. However, the turbidity plume generated, particularly at the open-lake disposal site, should dissipate before affecting shoreward areas.

2.3.3 Effects on Biota:

a. Primary Production, Photosynthesis - Temporary increases in turbidity and suspended solids generated during the discharge may cause minor decreases in primary production and photosynthesis. Reduced light penetration into the water column could have a temporary effect on phytoplankton and photosynthesis at the open-lake disposal area. However, studies have shown no statistically significant differences in algal populations exist between open-lake disposal sites and unaffected open-lake reference sites (Sweeney, 1978).

b. Suspension/Filter Feeders - Temporary interference with the activities of suspension/filter feeders may occur during the discharge period.

c. Sight Feeders - Temporary adverse impacts on sight feeders would occur as a result of temporary increases in turbidity and suspended solids. Some sedentary species may suffocate; more mobile species would temporarily avoid the area during disposal periods. It has been demonstrated that nekton are only slightly impacted at open-lake disposal sites after disposal operations and that recovery is relatively rapid (Sweeney, 1978). In order to avoid interference with fish spawning and migration, dredging is prohibited in the Maumee River lakeward to Island 18 during the period from 15 February through 15 June.

2.3.4 Actions Taken To Minimize Impacts. During dredging and disposal activities, the Contractor would be required to minimize turbidity and accidental spills of fuel, oil, and/or greases.

2.4 Contaminant Determinations.

2.4.1 The term "contaminant" is defined by U.S. Environmental Protection Agency Guidelines, 40 CFR 230.3 (e) as "a chemical or biological substance in a form that can be incorporated into, onto, or be ingested by and that harms aquatic organisms, consumers of aquatic aquatic organisms, or users of the aquatic environment, and includes but is not limited to the substances on the 307(a)(1) list of toxic pollutants promulgated on 31 January 1978 (43 FR 4109)."

2.4.2 Analysis of bottom sediments from the proposed open-lake disposal area and Toledo Harbor has indicated that proposed disposal operations would not introduce any chemical contaminants to the lake ecosystem beyond those which are currently present. The Toledo Harbor CDF has been used as a disposal site for "heavily polluted" dredged material since 1976. Consequently, its continued use would not result in the introduction of contaminants into the facility. Dredging operations would result in a relocation of sediment contaminants from the navigation channel to the open-lake disposal area and CDF. Although the total volume of contaminants would increase at both sites, relative contaminant concentrations would remain approximately the same as existing levels.

2.5 Aquatic Ecosystems and Organisms Determinations.

2.5.1 Effects on Plankton - Only minor, short-term (several hours) adverse effects would be expected to impact plankton due to temporary increases in turbidity and suspended solids levels during disposal operations. The results of a zooplankton (Daphnia magna) bioassay performed on harbor sediments classify the sediments as borderline nonpolluted/moderately polluted (T.P. Associates International, Inc., 1988). Effects on plankton would be greatest within the CDF where its gradual filling would result in eventual loss of all aquatic habitat.

2.5.2 Effects on Benthos - The disposal activities would result in the burial and mortality of benthic organisms. The results of a benthic macroinvertebrate (Hexigenia limbata) bioassay conducted on harbor sediments classified all but two sites as moderately polluted (10-50 percent mortality). The remaining two sites (at River Mile 1 and River Mile 4 - to be placed in the CDF) were classified as heavily polluted with mortalities greater than 50 percent (T.P. Associates International, Inc., 1988). Effects on benthos would be greatest within the CDF where its gradual filling would result in eventual loss of all aquatic habitat.

2.5.3 Effects on Nekton - Nektonic organisms (fish and other free-swimming aquatic animals) may be temporarily dispersed from the disposal areas during disposal activities. The results of a fish (Pimephales promela) bioassay of the harbor sediments classified the sediments as unpolluted with a mortality rate of less than 10 percent (T.P. Associates International, Inc., 1988). Effects on fish would be greatest within the CDF where its gradual filling would result in eventual loss of all aquatic habitat.

2.5.4 Effects on Aquatic Food Web - Except for waterfowl and other birds utilizing the CDF, aquatic biota in the confinement areais isolated from the Maumee Bay aquatic food web. Aquatic food webs within the CDF would continue to be degraded and would ulitimately be destroyed as the area is filled. Temporary effects on aquatic food webs at the open-lake site are expected due to the loss of benthic organisms due to burial and mortality.

2.5.5 Effects on Special Aquatic Sites:

a. Sanctuaries and Refuges - Not applicable.

b. Wetlands - Some wetland vegetation has colonized shallow water areas of the CDF. The presence of this vegetation is a direct result of reduced water depths and the placement of nutrient-rich dredged material within the facility. Additional wetland vegetation may temporarily colonize the CDF; however, this vegetation would ultimately be destroyed as the area is filled, dewatered, and converted to alternative uses. Although the loss of wetland areas may be significant, the continued filling of the CDF is expected to cause fewer adverse environmental impacts than construction of an alternative shallow water site or placing the heavily polluted dredged material in the open lake.

c. Mud Flats - Not applicable.

d. Vegetated Shallows - Not applicable.

e. Coral Reefs - Not applicable.

f. Riffle and Pool Complexes - Not applicable.

2.5.6 Threatened and Endangered Species. No Federal or State-listed threatened or endangered species are known to exist at the disposal sites. Therefore, no impacts to threatened or endangered species should occur.

2.5.7 Other Wildlife. Disruption and disturbance by equipment during disposal activities would result in a short-term avoidance of the project area by both game and non-game bird species. Although some waterfowl, gulls, and shorebirds utilize the CDF as a resting and feeding area, use of the site by other wildlife is relatively limited. The eventual filling of the CDF may cause some alteration in bird utilization of the Toledo waterfront but should have no noticeable impacts on wildlife in the Toledo area. In the past, avian mortalities associated with botulism outbreaks have occurred at the CDF. Low water levels, high summer temperatures, an abundance of decaying vegetation and anoxic conditions in the sediments contribute to the growth of naturally occurring bacteria which produce a fatal toxin. In 1989, the Corps of Engineers' Waterways Experiment Station will complete a study to develop a management plan to address this problem.

2.5.8 Actions Taken to Minimize Impacts. In order to avoid interference with fishery spawning activities and migrations, dredging is prohibited in the Maumee River lakeward to Island 18 during the period from 15 February through 15 June.

2.6 Proposed Discharge Site Determinations.

2.6.1 Mixing Zone Determinations. The following factors were considered in determining the adaptability of the mixing zone:

Water Depth	In the CDF, depths vary from 0 feet at the south end to about -3 feet LWD in the northern protion. Depths at the open-lake site range from -20 to -23 feet LWD.
Current Velocity, Direction and Variability	Water movement within the CDF is negligible, except as provided by wind action. Velocity and direction are variable at the open-lake site, controlled by prevailing winds and flows from the Maumee River and Detroit River.
Degree of Turbulence	Considerable water turbulence is generated at the open-lake site during Lake Erie storm

	conditions. Only minor water turbulence would be generated at the site by the disposal activities.
Stratification	No significant impacts on normal Lake Erie water stratification are expected.
Discharge Vessel Speed and Direction	Stationary
Ambient Concentrations of Constituents of Interest and Dredged Material Characteristics	See Section 1.4.1, General Characteristics of Material and Section 2.4, Contaminant Determinations
Number of Discharge Actions Per Unit Time	One discharge action every 1.5-5.0 hours (open-lake site and CDF). The frequency of each discharge action would be dependent upon the dredging site along the navigation channel, distance to the disposal site, and capacity of the discharge vessel.
Other Factors Affecting Rates and Patterns of Mixing	Water circulation currents and patterns at the open-lake site are influenced by Maumee River and Detroit River flows and prevailing winds.

2.6.2 Determination of Compliance with Applicable Water Quality Standards. The Ohio Environmental Protection Agency (OEPA) is reviewing this action for compliance with Section 401 of the Clean Water Act and State water quality standards. Section 401 Water Quality Certification will be granted pending OEPA's favorable review of this evaluation.

2.6.3 Potential Effects on Human Use Characteristics:

a. Municipal and Private Water Supply - Disposal of "heavily polluted" dredged material into the CDF would have no effect on municipal or public water supplies. The proposed open-lake disposal site was selected in response to concerns regarding the effect of past disposal operations on the cities of Toledo and Oregon water intakes. By siting the disposal area approximately two miles further to the north-northwest, there would be no adverse impacts upon public water supply intakes.

b. Recreational and Commercial Fisheries - No significant

effect.

c. Water-related Recreation - No significant effect. All dredging equipment would be adequately marked and lighted to avoid interference with recreational boating in the Maumee River and Bay, and Lake Erie.

d. Aesthetics - Dredging and disposal activities would temporarily increase turbidity in the project area, thereby detracting from the appearance of the area. However, the turbidity plume generated, particularly at the open-lake disposal site, should dissipate before affecting shoreward areas.

e. Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves - No effect.

2.6.4 Determination of Cumulative Effects on the Aquatic Ecosystem. The cumulative effect of the proposed action would be the total filling of the CDF resulting in the eventual elimination of all aquatic habitat within the containment area. Disposal at the open-lake site would result in minor changes in water depths within the area. Since the physical and chemical characteristics of dredged materials to be placed at the site during future disposal actions would be comparable to the characteristics of bottom sediments in place at the site, future discharges would not significantly interfere with the productivity or water quality of the existing aquatic ecosystem.

2.6.5 Determination of Secondary Effects on the Aquatic Ecosystem. Ownership of the filled CDF will eventually be transferred to the Toledo-Lucas County Port Authority, which has long-range plans to develop the general area for port expansion. However, sinc specific development plans for this area are not known, the magnitude cannot be determined at this time.

FINDING OF COMPLIANCE

OPERATIONS AND MAINTENANCE
TOLEDO HARBOR
LUCAS COUNTY, OH

1. No significant adaptations of the U.S. Environmental Protection Agency Guidelines were made relative to this evaluation.

2. Alternatives considered during the preparation of the Final Environmental Impact Statement (FEIS) for the Toledo Harbor CDF (1974) and the FEIS for harbor operations and maintenance (1976) included: no dredging; dredging to lesser depths; using other types of dredging equipment; watershed management; disposal of all sediments in open water; deep-water (>100 feet) disposal; upland disposal; and pretreatment of dredged materials. Based on environmental and economic considerations, the selected disposal methods were identified as the best immediate solution to the disposal of unpolluted and polluted dredged material. Since the CDF has historically been used for dredged material disposal, the continued use of this facility would result in less significant environmental impacts than construction of an new CDF at and undisturbed site.

3. The discharge of dredged material into Lake Erie and the Toledo Harbor CDF is not expected to violate State water quality standards outside of the localized mixing zone. The disposal activities would not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

4. Use of the selected discharge sites would not jeopardize the continued existence of any species listed as endangered or threatened under the Endangered Species Act of 1973, as amended, or result in the liklihood of the destruction or adverse modification of their critical habitat. The proposed discharge would not violate any requirement imposed by the Secretary of Commerce to protect any marine sanctuary designated under the Marine Protection, Research, and Sanctuaries Act of 1972.

5. The proposed discharge of dredged material would not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. Significant adverse effects on the life stages of aquatic life and other wildlife dependent on aquatic systems would not occur. The discharge would have no significant adverse effects on aquatic ecosystem diversity, productivity, and stability, or on recreational aesthetic and economic values.

6. Appropriate steps to minimize potential adverse impacts of the discharge on aquatic systems include:

•Dredging in the Maumee River lakeward to Island 18 would be prohibited during the period from 15 Feruary through 15 June in order to avoid interference with fish spawning and migration.

•The proposed open-lake disposal site has depths adequate to receive harbor dredgings without adversely affecting substrate elevation and slope, current patterns and circulation, or normal water level fluctuations.

•Bottom sediments at the open-lake site have similar physical, chemical, and biological characteristics to the harbor sediments; therefore, significant substrate alterations would not occur.

•The discharge vessel would stop above the center of the open-lake disposal area during discharge in order to minimize the lateral movement of material from the site.

•The open-lake disposal area has been sited at a sufficient distance from the cities of Toledo and Oregon water intakes to minimize adverse impacts on public water supplies.

•Heavily polluted dredged material would be dischargd into the Toledo Harbor CDF to minimize adverse impacts on water chemistry and local nutrient levels.

•During disposal activities, the Contractor would be required to minimize turbidity and accidental spills of fuels, oils, and/or greases.

7. On the basis of the Guidelines, the proposed discharge site for the placement of dredged material is specified as complying with the inclusion of appropriate and practical conditions to minimize pollution and adverse effects on the aquatic ecosystem.

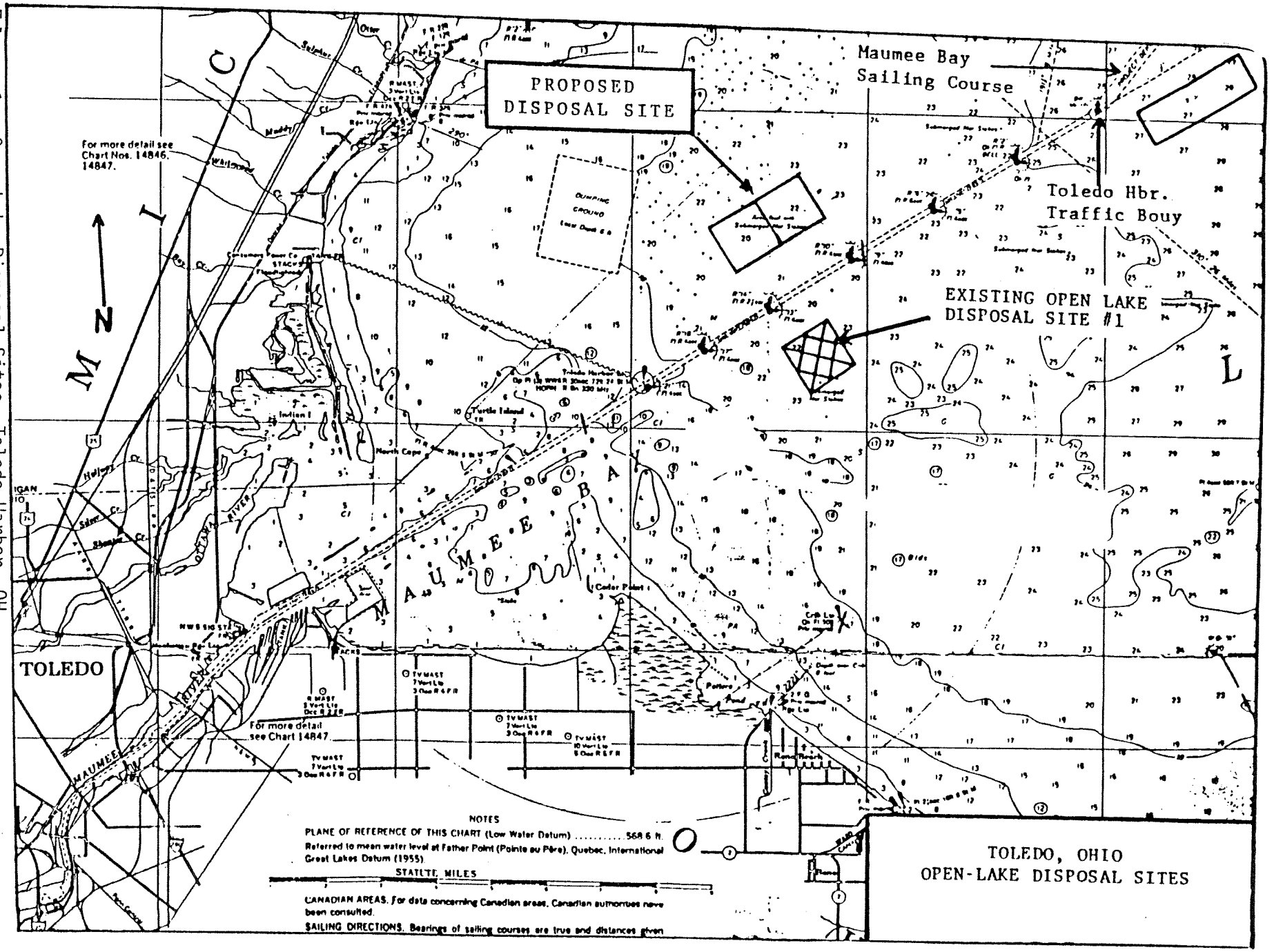

Figure 1. Open-Lake Disposal Sites, Toledo Harbor, OH

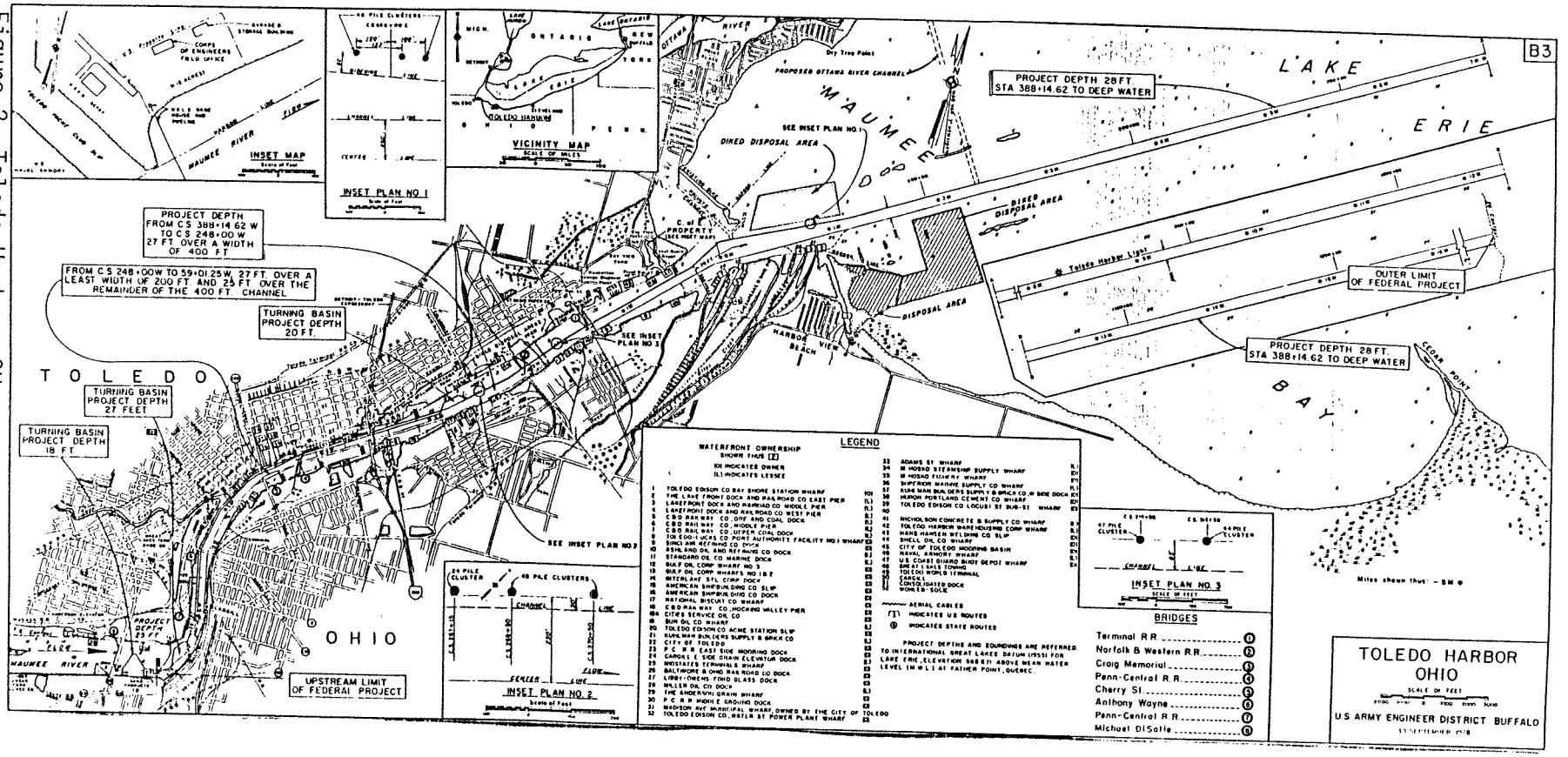

Figure 2. Toledo Harbor, OH

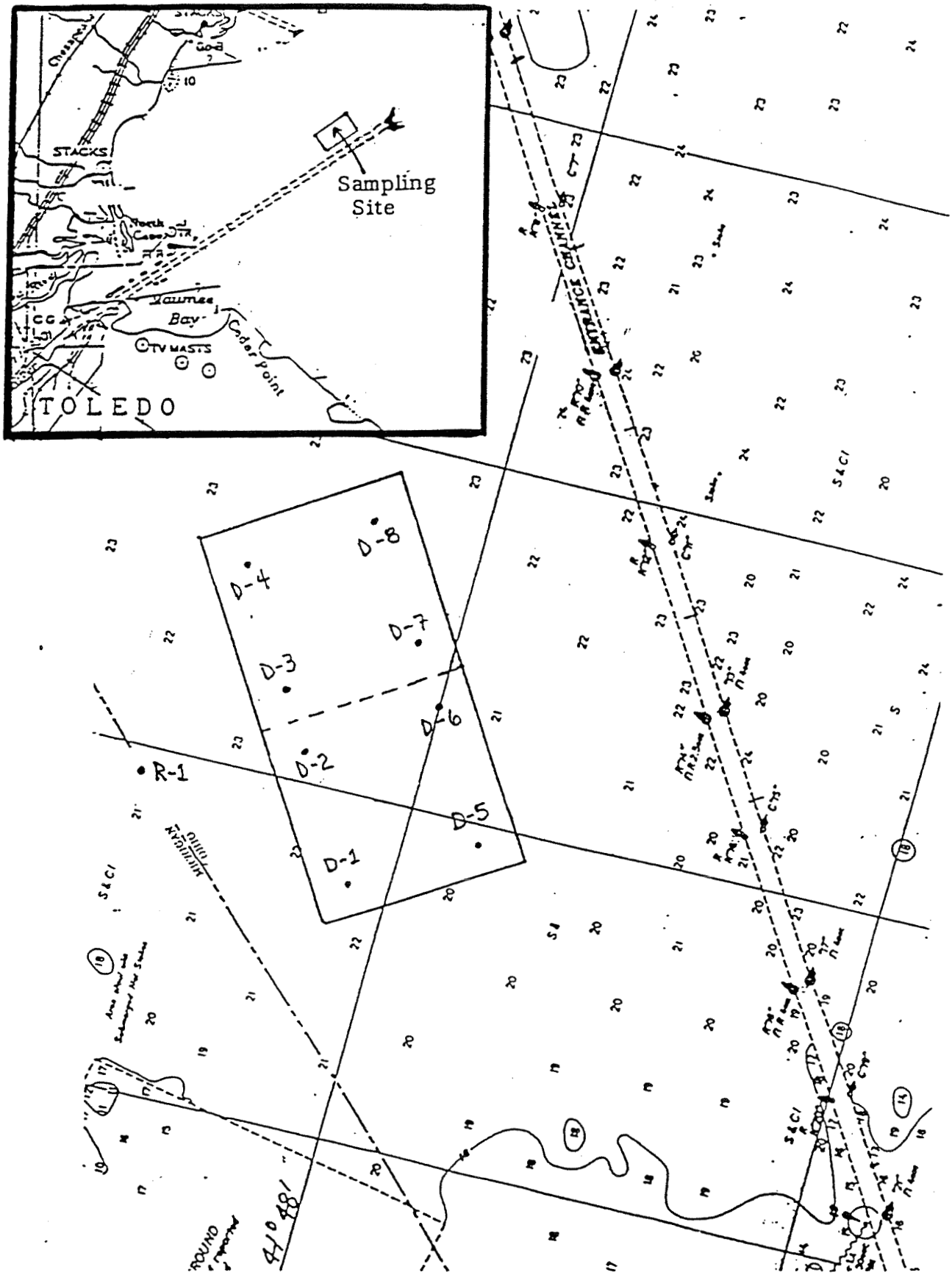

Figure 3. Open-Lake Disposal Site Sampling Locations, Toledo Harbor, OH

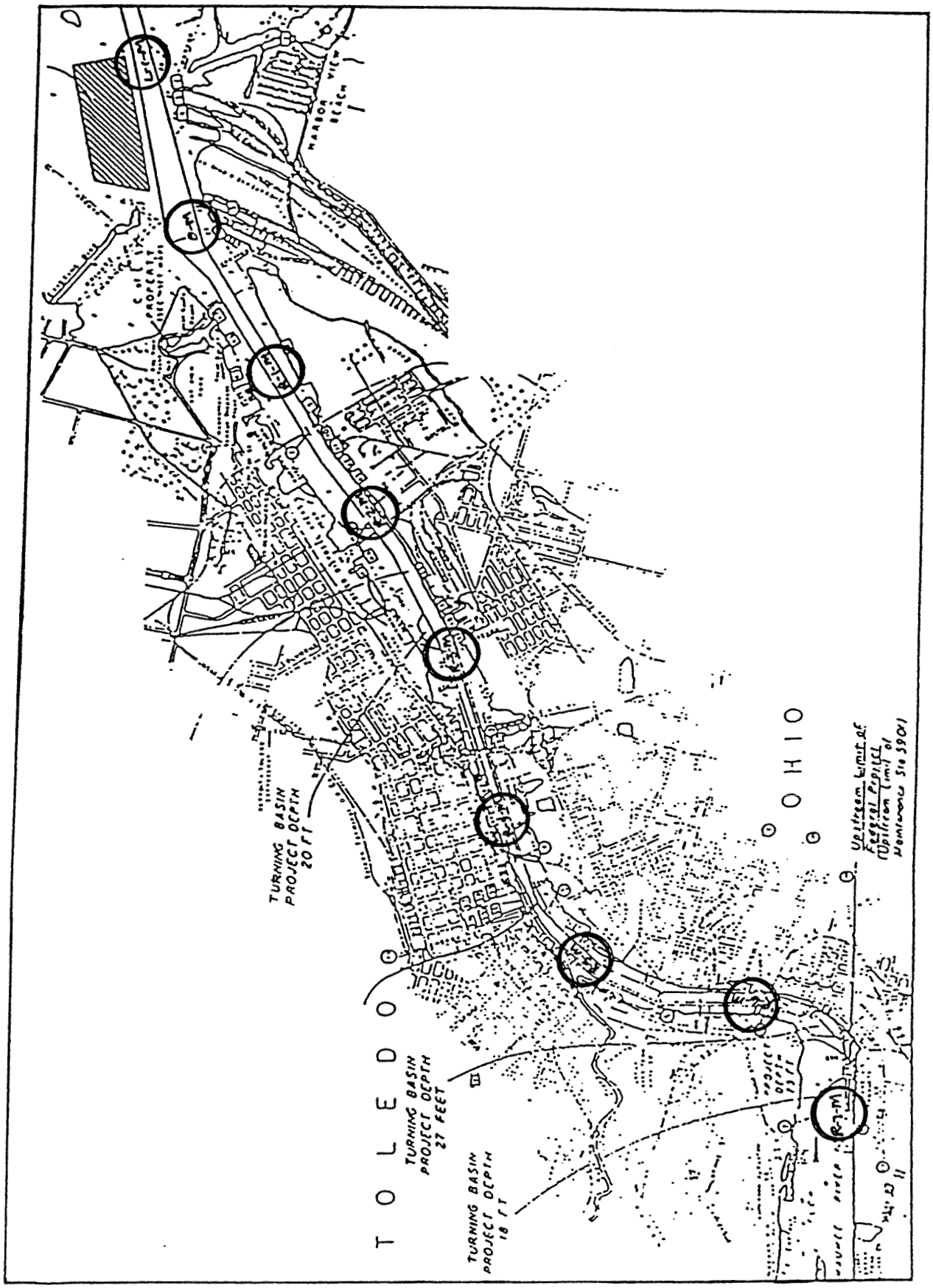

Figure 4. Harbor Sampling Sites, Toledo Harbor, OH

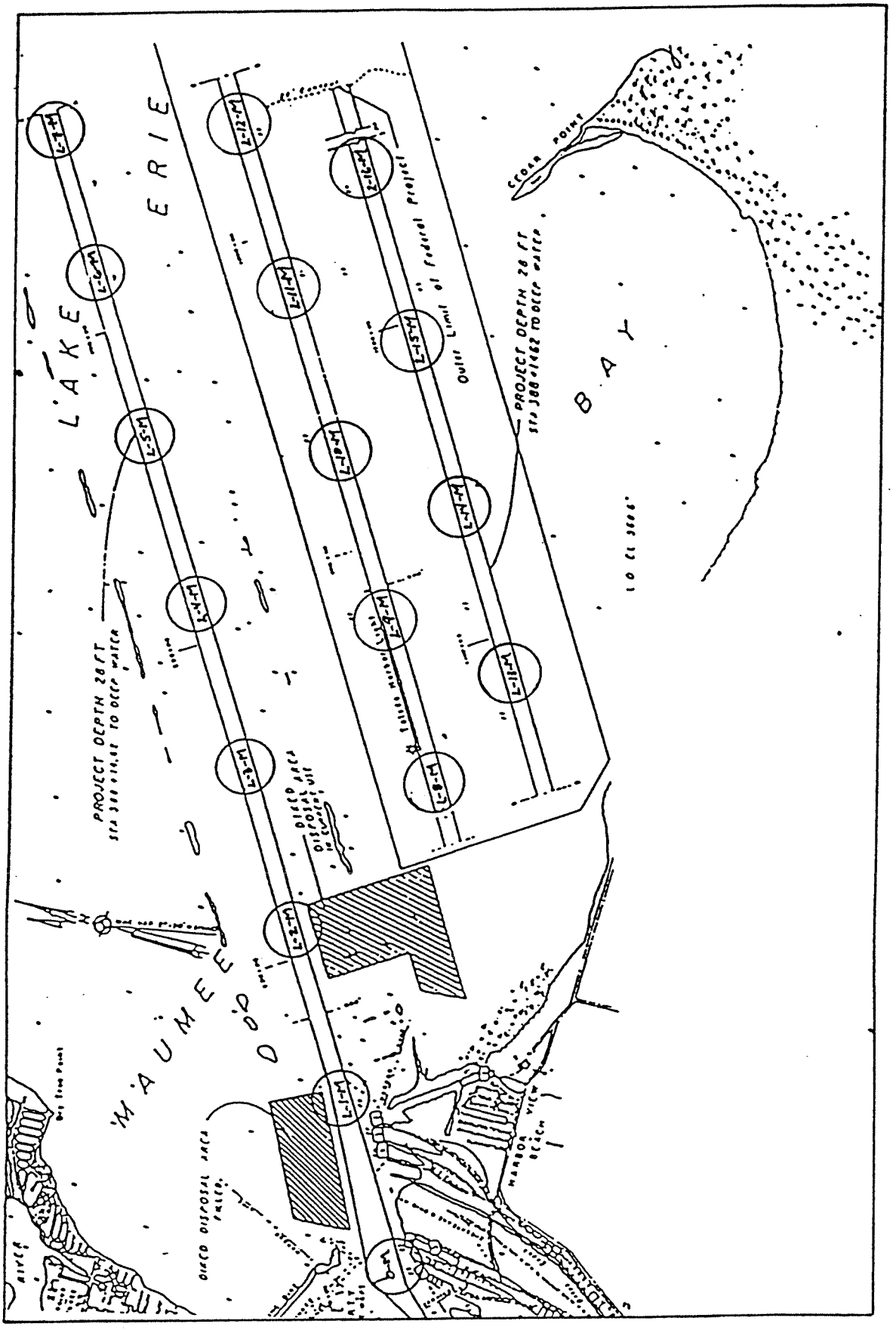

Figure 4. Harbor Sampling Sites, Toledo Harbor, OH (cont'd)

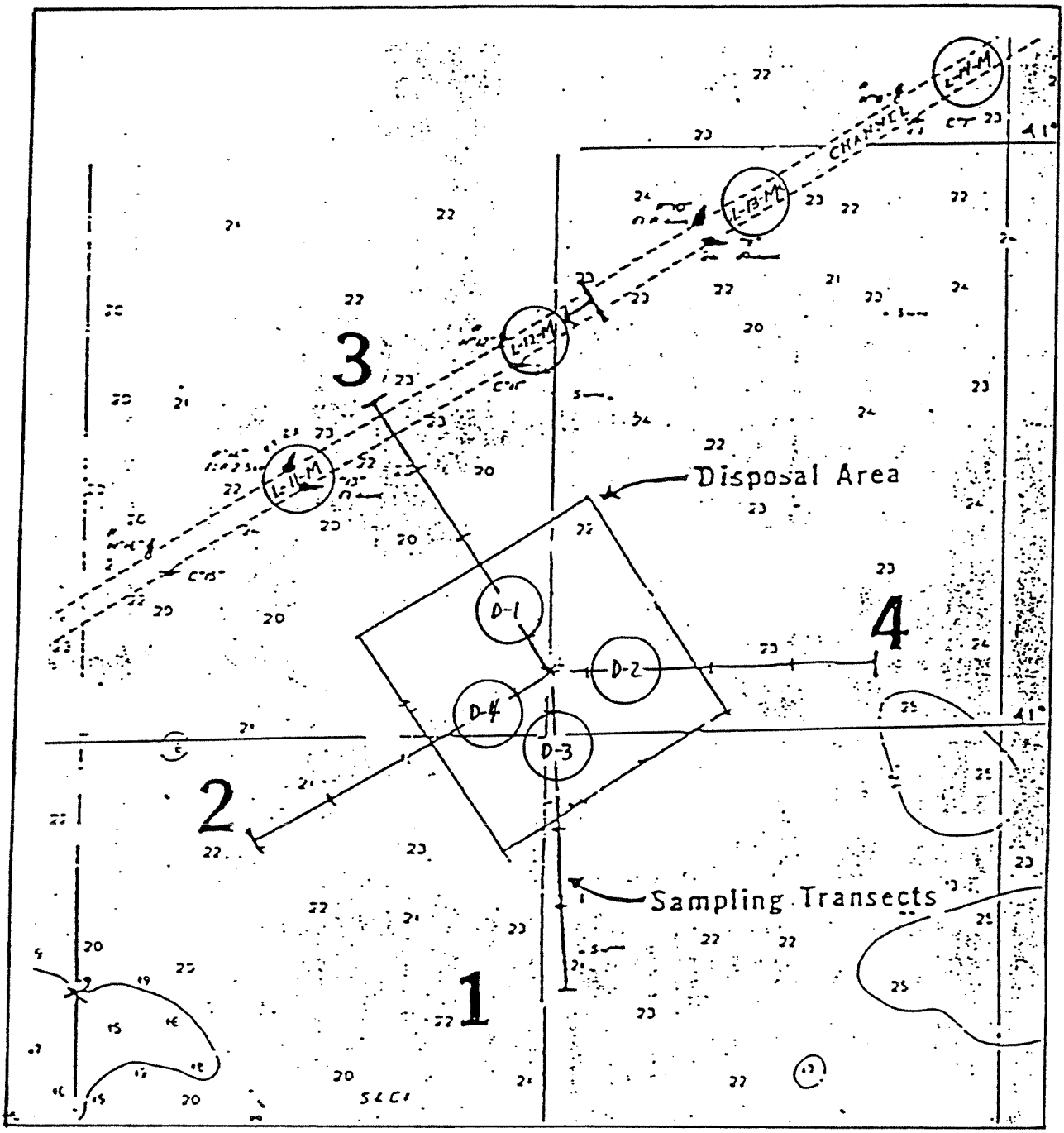

Figure 4. Harbor Sampling Sites, Toledo Harbor, OH (cont'd)

Table 1. Bulk Inorganics Data - Proposed Open-Lake Disposal Site, Toledo, OH

LAB NO. / IDENTIFICATION	7792-87 D-1	7793-87 D-2	7794-87 D-3	7795-87 R-1	7796-87 D-4
ARSENIC, TOTAL, AS	8	4	6	9	4
BARIUM, TOTAL, BA	76	33	47	62	31
CADMIUM, TOTAL, CD	2	1	2	2	1
CHROMIUM, TOTAL, CR	36	14	25	31	13
COD	120000	53000	44000	65000	58000
COPPER, TOTAL, CU	47	17	30	40	16
CYANIDE, TOTAL, CN	<0.76	<0.42	<0.51	0.54	<0.37
IRON, TOTAL, FE	7600	7500	7900	7800	7800
LEAD, TOTAL, PB	53	19	34	44	21
MANGANESE, TOTAL, MN	400	180	260	340	170
MERCURY, TOTAL, HG	0.75	0.12	0.37	0.64	0.13
NICKEL, TOTAL, NI	42	18	27	35	16
NITRATE N	<3	1	<2	<2	<2
NITROGEN, AMMONIA, N	86	37	46	60	31
OIL/GREASE	1100	432	969	856	444
PHENOLS, 4-AAP	<0.152	<0.086	<0.097	<0.124	<0.055
PHOSPHORUS, TOTAL, P	6060	2200	1820	1750	2190
RESIDUE, T. VOLATILE, %	7.29	2.64	3.71	4.26	2.53
RESIDUE, TOTAL (TS), %	32.0	55.8	48.0	41.2	63.6
TOTAL KJELDAHL N	3660	869	1310	1970	966
ZINC, TOTAL, ZN	180	71	130	160	69

LAB NO. / IDENTIFICATION	7797-87 D-8	7798-87 D-7	7798-87 D-6	7800-87 D-5
ARSENIC, TOTAL, AS	14	8	9	7
BARIUM, TOTAL, BA	80	47	70	55
CADMIUM, TOTAL, CD	2	2	2	1
CHROMIUM, TOTAL, CR	34	21	32	30
COD	85000	63000	71000	59000
COPPER, TOTAL, CU	47	28	43	38
CYANIDE, TOTAL, CN	<0.58	<0.53	<0.64	<0.46
IRON, TOTAL, FE	7500	7800	7600	15000
LEAD, TOTAL, PB	49	62	52	46
MANGANESE, TOTAL, MN	400	240	350	140
MERCURY, TOTAL, HG	0.99	0.58	0.97	1.11
NICKEL, TOTAL, NI	43	24	39	34
NITRATE N	<3	<2	<2	<2
NITROGEN, AMMONIA, N	91	62	59	46
OIL/GREASE	828	487	873	967
PHENOLS, 4-AAP	<0.139	<0.108	<0.111	<0.108
PHOSPHORUS, TOTAL, P	2720	1670	1740	1980
RESIDUE, T. VOLATILE, %	5.97	4.23	5.79	5.9
RESIDUE, TOTAL (TS), %	33.7	41.4	36.3	44.5
TOTAL KJELDAHL N	2890	1670	2020	2100
ZINC, TOTAL, ZN	170	110	160	160

Above data, except as noted, reported as mg/kg (dry wt. basis).

SOURCE: T.P. Associates International, Inc., 1987.

Table 2. Bulk Inorganics Data - Toledo Harbor, OH

LAB NO. / IDENTIFICATION	4353-88 D-4	4354-88 D-3	4355-88 D-2	4356-88 D-1	4357-88 L-16-M	4358-88 L-15-M	4359-88 L-14-M	4360-88 L-13-M	4361-88 L-12-M	4362-88 L-11-M	4363-88 L-10-M	4364-88 L-9-M	4365-88 L-8-M	4366-88 L-7-M
ARSENIC, TOTAL, AS, MG/KG	18	22	14	15	9	16	13	9	19	18	21	17	14	16
BARIUM, TOTAL, BA, MG/KG	67	79	87	60	29	49	42	31	60	60	69	53	67	74
CADMIUM, TOTAL, CD, MG/KG	1	3	3	2	2	3	3	2	3	2	2	2	2	0.9
CHROMIUM, TOTAL, CR, MG/KG	25	48	78	25	32	49	38	28	37	31	30	19	21	18
COD, MG/KG	51000	110000	96000	57000	34000	72000	53000	38000	76000	74000	93000	67000	63000	76000
COPPER, TOTAL, CU, MG/KG	31	54	58	37	32	50	39	30	44	43	41	31	29	28
CYANIDE, TOTAL, CN, MG/KG	<0.5	<0.6	<0.7	<0.4	<0.3	<0.5	<0.5	<0.4	0.69	0.35	0.75	0.4	0.23	0.52
IRON, TOTAL, FE, MG/KG	20300	26000	25500	19300	12600	17700	14700	11300	22300	17600	23300	15300	18000	20300
LEAD, TOTAL, PB, MG/KG	29	57	69	35	40	67	45	34	59	48	38	23	33	25
MANGANESE, TOTAL, MN, MG/KG	400	440	500	360	280	400	350	255	400	400	440	450	360	440
MERCURY, TOTAL, HG, MG/KG	0.1	0.6	0.5	0.2	0.3	0.7	0.5	0.3	0.4	0.3	0.3	0.3	0.2	0.1
NICKEL, TOTAL, NI, MG/KG	29	52	56	33	30	49	39	32	42	38	39	28	25	29
NITRATE N, MG/KG	<7	<12	<12	<9	<6	<9	<9	<7	<11	<11	<13	<10	<7	<10
NITROGEN, AMMONIA, N, MG/KG	87	89	96	120	21	50	42	37	93	110	170	81	59	120
OIL/GREASE, MG/KG	270	400	650	320	880	830	520	250	650	460	590	4300	620	420
PHENOLS, 4-AAP, MG/KG	0.23	0.24	0.25	0.14	0.26	0.13	0.14	0.16	0.28	0.20	0.20	0.18	0.10	0.19
PHOSPHORUS, TOTAL, P, MG/KG	870	890	1100	780	570	830	710	560	760	780	750	700	760	750
RESIDUE, T. VOLATILE, %	4.50	6.60	5.67	2.32	2.51	5.12	4.81	3.23	4.67	4.89	6.61	4.77	3.88	5.52
RESIDUE, TOTAL (TS), %	48.3	33.2	31.0	42.2	59.4	38.5	42.2	54.0	35.0	36.3	30.0	38.2	48.8	39.3
TOTAL KJELDAHL N, MG/KG	1320	1330	1470	1080	472	952	852	649	1050	1440	1470	1300	1060	1270
ZINC, TOTAL, ZN, MG/KG	110	210	230	130	130	200	160	110	160	160	150	100	100	100

LAB NO. / IDENTIFICATION	4367-88 L-6-M	4368-88 L-5-M	4369-88 L-4-M	4370-88 L-3-M	4371-88 L-2-M	4372-88 L-1-M	4373-88 O-M	4374-88 R-1-M	4375-88 R-2-M	4376-88 R-3-M	4377-88 R-4-M	4378-88 R-5-M	4379-88 R-6-M	4380-88 R-7-M
ARSENIC, TOTAL, AS, MG/KG	16	15	20	18	20	22	20	21	22	23	12	22	18	16
BARIUM, TOTAL, BA, MG/KG	76	72	90	82	92	110	100	120	120	120	70	110	82	65
CADMIUM, TOTAL, CD, MG/KG	1	1	1	1	2	2	2	2	2	2	2	1	0.9	2
CHROMIUM, TOTAL, CR, MG/KG	19	18	20	17	23	24	31	67	39	24	14	20	16	13
COD, MG/KG	76000	72000	82000	74000	86000	97000	83000	120000	84000	87000	46000	82000	58000	61000
COPPER, TOTAL, CU, MG/KG	27	29	32	29	33	37	38	52	39	36	27	40	26	23
CYANIDE, TOTAL, CN, MG/KG	0.6	0.56	0.48	0.47	0.7	1.5	0.52	1.58	0.67	0.98	<0.3	0.5	<0.6	<0.3
IRON, TOTAL, FE, MG/KG	18900	14400	23100	16000	22900	24900	27200	31500	29000	30600	13900	24500	19900	13200
LEAD, TOTAL, PB, MG/KG	24	24	23	23	29	26	34	52	29	32	23	41	19	16
MANGANESE, TOTAL, MN, MG/KG	360	370	400	355	470	460	390	420	530	470	320	440	340	335
MERCURY, TOTAL, HG, MG/KG	0.3	0.1	0.1	0.3	0.1	0.1	0.2	0.4	0.2	0.1	0.2	0.2	0.1	0.2
NICKEL, TOTAL, NI, MG/KG	25	23	27	24	30	32	33	46	33	31	19	27	23	23
NITRATE N, MG/KG	<9	<8	<10	<9	<10	<9	<9	<10	<10	<10	<6	<9	<7	<8
NITROGEN, AMMONIA, N, MG/KG	160	140	110	160	200	180	270	870	210	150	88	150	91	89
OIL/GREASE, MG/KG	330	30	340	380	680	900	1300	3900	1100	710	340	980	270	430
PHENOLS, 4-AAP, MG/KG	0.23	0.13	0.20	<0.10	0.39	0.23	0.21	0.69	0.29	0.16	0.13	0.17	0.13	0.12
PHOSPHORUS, TOTAL, P, MG/KG	770	830	840	900	980	1100	1200	3500	1400	1100	840	1100	820	735
RESIDUE, T. VOLATILE, %	5.68	6.11	5.98	4.83	7.16	7.58	6.63	8.84	7.45	7.29	4.29	10.0	4.25	7.47
RESIDUE, TOTAL (TS), %	44.4	46.2	38.9	43.3	36.9	37.6	42.3	36.8	37.0	37.6	54.7	41.5	46.6	47.6
TOTAL KJELDAHL N, MG/KG	1460	1450	1500	1810	1420	1870	1700	2620	1630	2860	1630	2750	1690	1980
ZINC, TOTAL, ZN, MG/KG	95	100	110	98	120	150	140	330	170	160	93	150	97	82

SOURCE: T.P. Associates International, Inc., 1988.

Table 3. Pollutional Classification of Great Lakes Harbor Sediments (U.S. Environmental Protection Agency, 1977).

Parameter	Criteria		
	Unpolluted	Moderately Polluted	Highly Polluted
T. Solids (%)	NC	NC	NC
Volatile Solids (%)	<5	5-8	>8
Ammonia, N	<75	75-200	>200
TKN	<1,000	1,000-2,000	>2,000
Total P	<420	420-650	>650
COD	<40,000	40,000-80,000	>80,000
Cyanide	<0.1	0.1-0.25	>0.25
Phenols	NC	NC	NC
Arsenic	<3	3-8	>8
Barium	<20	20-60	>60

Table 3. Pollutional Classification of Great Lakes Harbor Sediments (cont'd)

Parameter	Criteria		
	Unpolluted	Moderately Polluted	Highly Polluted
Cadmium	*	*	>6
Chromium	<25	25-75	>75
Copper	<25	25-50	>50
Iron	<17,000	17,000-25,000	>25,000
Lead	<40	40-60	>60
Manganese	<300	300-500	>500
Mercury	*	*	≥1.0
Nickel	<20	20-50	>50
Zinc	<90	90-200	>200
Oil/Grease	<1,000	1,000-2,000	>2,000

All units are in mg/kg, unless otherwise noted.

Table 4. Elutriate Data - Toledo Harbor, OH

LAB NO. IDENTIFICATION	4778-88 D-4	4779-88 D-3	4780-88 D-2	4781-88 D-1	4782-88 L-16-M	4783-88 L-15-M	4784-88 L-14-M	4785-88 L-13-M	4786-88 L-13-M RPT.	4787-88 BLANK	4788-88 L-12-M	4789-88 L-11-M	4790-88 L-10-M	4791-88 L-9-M	4792-88 L-8-M	4793-88 L-7-M
ARSENIC, TOTAL, AS, UG/L	8	<5	<5	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	5
BARIUM, TOTAL, BA, UG/L	170	200	170	180	180	170	190	190	170	170	54	150	180	190	190	240
CADMIUM, TOTAL, CD, UG/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
CHROMIUM, TOTAL, CR, UG/L	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	31	30
COPPER, TOTAL, CU, UG/L	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
CYANIDE, TOTAL, CN, MG/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
IRON, TOTAL, FE, UG/L	160	200	220	220	160	310	280	130	160	56	77	85	110	110	85	150
LEAD, TOTAL, PB, UG/L	<5	<5	<5	<5	<5	<5	6	<5	<5	<5	<5	<5	<5	<5	<5	<5
MANGANESE, TOTAL, MN, UG/L	420	540	660	640	470	540	720	530	600	91	99	360	1000	590	450	1200
MERCURY, TOTAL, HG, UG/L	<2.0	2.0	<2.0	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	<2.0	<2.0	3.0	<2.0	2.0	2.0
NICKEL, TOTAL, NI, UG/L	<30	<30	<30	37	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
NITRATE N, MG/L	0.14	0.11	<0.08	<0.08	0.11	<0.08	<0.08	<0.08	<0.08	<0.08	0.14	<0.08	<0.08	<0.08	<0.08	<0.08
NITROGEN, AMMONIA, N, MG/L	2.53	1.98	1.68	4.11	1.33	1.80	1.50	1.59	1.57	<0.02	2.21	3.25	5.11	2.93	1.77	5.92
OIL/GREASE, MG/L	24	1	5	<1	1	<1	1	2	2	<1	<1	1	2	<1	3	<1
PHENOLS, 4-AAP, MG/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	0.01	<0.01	<0.01
PHOSPHORUS, TOTAL, P, MG/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
TOTAL KJELDAHL N, MG/L	3.00	2.04	1.71	4.22	1.50	1.81	1.90	1.78	1.63	<0.10	2.56	3.76	5.54	3.23	1.89	7.02
ZINC, TOTAL, ZN, UG/L	55	47	41	40	35	33	42	35	29	<20	<20	25	41	34	23	53

LAB NO. IDENTIFICATION	4794-88 L-6-M	4795-88 L-5-M	4796-88 L-4-M	4797-88 L-3-M	4798-88 L-3-M RPT.	4799-88 L-2-M	4800-88 L-1-M	4801-88 O-M	4802-88 R-1-M	4803-88 R-2-M	4804-88 R-3-M	4805-88 R-4-M	4806-88 R-5-M	4807-88 R-6-M	4808-88 R-7-M	4809-88 R-7-M RPT.
ARSENIC, TOTAL, AS, UG/L	<5	5	11	6	7	7	8	5	8	11	11	14	18	12	16	12
BARIUM, TOTAL, BA, UG/L	180	180	190	190	250	170	190	190	230	150	180	200	200	140	190	190
CADMIUM, TOTAL, CD, UG/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
CHROMIUM, TOTAL, CR, UG/L	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
COPPER, TOTAL, CU, UG/L	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
CYANIDE, TOTAL, CN, MG/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
IRON, TOTAL, FE, UG/L	130	130	140	110	120	250	400	110	450	110	230	110	100	92	180	110
LEAD, TOTAL, PB, UG/L	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
MANGANESE, TOTAL, MN, UG/L	980	390	1300	1100	1100	1400	1400	410	690	580	1200	830	640	670	1000	1100
MERCURY, TOTAL, HG, UG/L	<2.0	4.0	<2.0	<2.0	<2.0	11.0	3.0	<2.0	<2.0	<2.0	<2.0	22	4.0	3.0	<2.0	<2.0
NICKEL, TOTAL, NI, UG/L	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
NITRATE N, MG/L	<0.08	0.18	<0.08	0.11	0.11	<0.08	<0.08	0.43	<0.08	0.36	0.14	0.39	0.29	0.32	0.11	0.18
NITROGEN, AMMONIA, N, MG/L	8.33	6.55	6.11	6.80	7.44	8.38	8.02	8.03	27.5	6.70	6.37	4.04	5.14	3.49	4.41	4.10
OIL/GREASE, MG/L	8	<1	<1	1	<1	1	<1	<1	4	4	<1	<1	1	<1	1	<1
PHENOLS, 4-AAP, MG/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PHOSPHORUS, TOTAL, P, MG/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.11	0.18	0.23	<0.10	0.11	<0.10
TOTAL KJELDAHL N, MG/L	8.79	6.74	6.20	7.56	8.30	8.80	8.60	8.50	30.6	7.20	6.60	4.80	5.40	3.70	5.30	5.00
ZINC, TOTAL, ZN, UG/L	41	37	54	46	61	34	37	41	51	27	29	44	52	28	46	47

SOURCE: T.P. Associates International, Inc., 1988.

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