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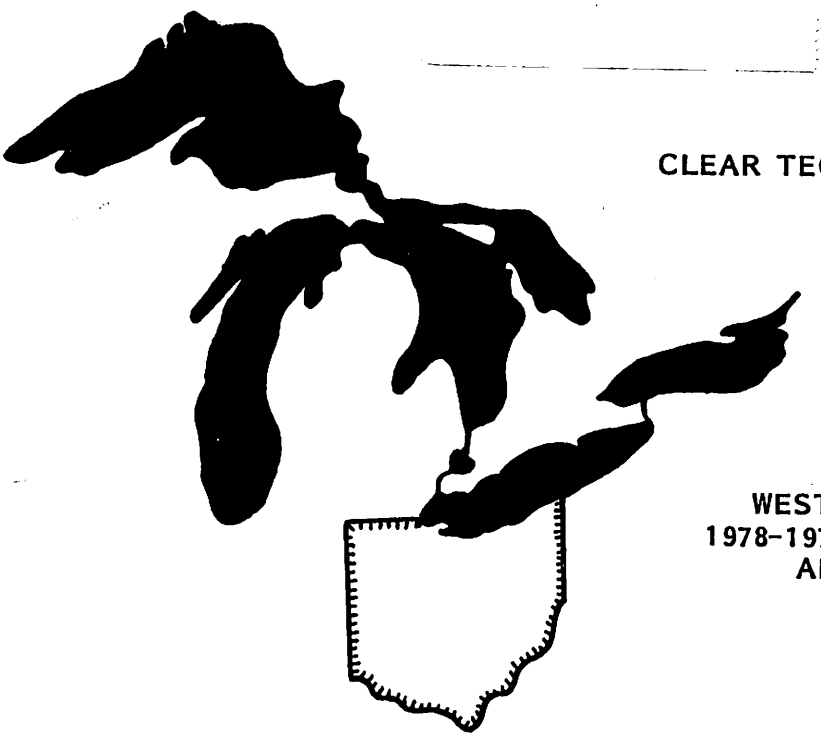

CLEAR TECHNICAL REPORT NO. 204:1

WESTERN BASIN NEARSHORE, 1978-1979, INTRODUCTION, METHODS AND QUALITY CONTROL

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Prepared for

U.S. Environmental Protection Agency
Great Lakes National Program Office
Region V - Chicago, Illinois
Grant No. R005351-01-0

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COLUMBUS, OHIO

September, 1984

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INTRODUCTION

Background

Lake Erie, as one of the Great Lakes of North America, represents a significant source of fresh surface water for the people of Canada and the United States. In recognition of the importance of this resource and the need to restore and maintain its water quality, the Canadian and United States governments entered into the Great Lakes Water Quality Agreement in 1972. The Agreement was reaffirmed in 1978 by further actions to enhance water quality in the Great Lakes Basin ecosystem.

The International Joint Commission has been mandated to assist in the implementation of these agreements. Within that mandate, the Commission is to collect, analyze and disseminate information relating to Great Lakes water quality. Recognizing the need for a uniform surveillance effort by both parties of the agreements and the cooperating state and provincial jurisdictions, the Commission directed the Water Quality Board to develop an international surveillance plan. Work groups were established for each lake, with the responsibility for developing detailed plans.

The Lake Erie Work Group prepared a nine-year surveillance plan in 1977, which was designed to provide an understanding of the overall, long-range responses of the lake to pollution abatement efforts. The nearshore portion of the plan called for intensive investigations in 1978 and 1979 and less intensive annual studies for the period 1980-1986. With the support of the United States Environmental Protection Agency, Environment Canada, the Ontario Ministry of Environment and various other federal and state agencies, the majority of the recommended plan was implemented on schedule. The 1978-1979 western Lake Erie nearshore surveillance cruises were conducted by the Ohio State University, Center for Lake Erie Area Research under USEPA sponsorship. The results of these cruises are presented in this report.

The nearshore zone is the area of largest interaction between water quality and the water user. It is the source of all water for public and industrial water supply. It is the site of virtually all recreational use and it is the most important area for the propagation and support of all aquatic life forms. With the exception of that portion of atmospheric deposition falling on the main body of the lake, the nearshore zone is the recipient of most waste input. For this reason, these waters are the first to show signs of degradation and are the first indicators of progress in abating pollution.

Objectives

In light of the above considerations, the nearshore surveillance study is designed to meet the general objectives of the Lake Erie plan:

1. To search for, monitor, and quantify violations of the existing Agreement objectives (general and specific), the IJC recommended objectives, and jurisdictional standards, criteria and objectives.

2. To monitor local and whole lake response to abatement measures and to identify emerging problems.

3. To determine the cause-effect relationship between water quality and inputs in order to develop the appropriate remedial/preventative actions and predictions of the rate and extent of local/whole lake responses to alternative abatement proposals.

4. To determine the long-term trophic state of Lake Erie and determine to what degree remedial measures have affected improvements.

5. To assess the presence, distribution, and impact by toxic substances.

6. To indicate the requirements for and direction of additional remedial programs, if necessary, to protect water uses.

The intensive element of the study is designed to provide information for detailed assessments of nearshore water quality as well as providing for linkage with the main lake intensive element.

To achieve a comprehensive nearshore surveillance investigation of western Lake Erie that meets the plan objectives, the following criteria were established. These criteria were developed in such a way as to provide for long-term and inter-agency consistency in sampling strategy which will result in reliable assessments of nearshore water quality on a whole lake basis.

Water Biota and Sediment Quality Parameters. The parameters selected for this study are listed in Tables 1 and 2. To facilitate problem area assessment, emphasis has been placed on those parameters subject to non-compliance with Agreement objectives and/or jurisdictional criteria standards of guidelines. Abbreviations for water and sediment quality parameters listed in Tables 1 and 2 are used throughout the text of this report for the purpose of brevity.

Station Location. Stations were selected at 78 locations along the Michigan and Ohio shoreline of Lake Erie (Figures 1-5). Geographic coordinates for these stations are listed in Table 3. The selection of station locations was based on an assessment of available historical data and information on mixing and dispersion of tributary water masses, prevailing currents, lake meteorology and bathymetry. The following design criteria were used to effect a consistency in sample collection for all nearshore work in Lake Erie.

1. Stations with historical long-term data bases were maintained for the continuance of trend evaluations.

2. Stations were located at or near significant point sources, significant tributaries, and past, potential and/or existing problem areas to assess the extent of zones of influence.

3. Stations were located at or near those municipal intakes identified as useful for monitoring trends in order to verify how representative intake sampling is of nearshore water quality.

4. The use of inshore/offshore transects perpendicular to shore is required to detect inshore/offshore water quality gradients. Stations along such transects are depth and/or distance related depending on local bathymetry, source influences, and local mixing. Transects were located near point sources, tributaries, problem areas, intakes, and extended from the main lake station grid.

5. The intensive element included stations sampled along transects which extend to the main lake station grid, permitting detail for a whole lake assessment.

Station Grouping. For analysis purposes stations have been grouped geographically into seven reaches consisting of from 8 to 18 stations each (Table 4) and seven transects consisting of from 3 to 7 stations each (Table 5). The reaches were established on the basis of relatively homogeneous geographic areas. The most shoreward stations in each reach are designated as inshore stations and the most lakeward stations are designated as offshore stations, but all stations are within what is defined as the nearshore zone. Within each reach, a transect was also established approximately normal to the shoreline. Each transect starts at a major tributary mouth and terminates at an offshore station. Transects were established to trace the influence of stream flow on the nearshore waters of the lake. In order to determine water quality gradient from nearshore to open lake waters, a series of 20 station couplets were established along the entire study area (Table 6). Each couplet consists on an inshore and an offshore station (Figures 6 and 7), all within the nearshore zone. For the purposes of this report, all stations are considered within the nearshore zone, a zone extending from the shoreline to approximately seven kilometers offshore.

Sampling Depths. The number of samples taken at each station was determined by water depth. At stations where the depth was less than 4.0 meters, only one sample was taken, 1.0 meter below the surface (designated as a surface sample). At deeper stations, a surface sample and a sample 1.0 meter above the bottom (designated as a bottom sample) were obtained. At stations deeper than 10 meters a bathythermograph recording was made to determine the presence or absence of thermal stratification.

Sampling Frequency. The intensive nearshore study consisted of four cruises per year (1978 and 1979):

SCHEDULE FOR WESTERN LAKE ERIE CRUISES

Cruise No.	Calendar Date	Julian Date
	1978	
1	April 14 -April 29	104-119
2	June 26 - July 12	177-193
3	August 23 - September 11	235-254
4	October 3 - October 17	276-290
	1979	
1	March 29 - April 15	088-105
2	July 25 - August 5	206-217
3	September 9 - September 23	252-266
4	October 9 - October 23	282-296

The rationale for scheduling of cruises included:

1. Spring cruises were designed primarily to detect the extent and impact of tributary loadings during annual high flow events.

2. Summer cruises were designed to measure peak summer productivity during maximum ambient light conditions and to measure public health indicators during peak periods of recreational water use.

3. Late summer cruises were designed to measure bottom oxygen and nutrients during the most critical time of the year for hypolimnion anoxia in the Central Basin of Lake Erie.

4. Fall cruises were designed primarily to measure the extent of bottom oxygen recovery as a result of vertical mixing and to measure the extent of nutrient regeneration from sediment.

The sampling frequency consisted of three, consecutive day runs per nearshore cruise. This frequency was selected to provide increased accuracy of statistical evaluations, particularly for geographic grouping of data.

METHODS

This study represents the most intensive limnological effort undertaken in the nearshore zone of Lake Erie. Therefore, the sampling scheme was fairly complex. Not all parameters were examined with equal intensity throughout the study (Table 7). In addition to sampling variations specified in Table 7 for cruise, run and depth, there were several modifications made from 1978 to 1979. Based on the results of the first field season, several parameters were reduced or eliminated in 1979. In 1979, chlorides, sulfates, phytoplankton and zooplankton were collected at only six stations instead of all 78 stations as in 1978. The six stations included were M3, M14, 05, 024, 035 and 046. Benthos samples were collected during the spring and early summer cruise in 1978 and only during the early summer cruise in 1979. Color, fluoride and organic contaminants in water analyses were eliminated in 1979.

Water Quality

The 68-foot research vessel Hydra was utilized to conduct all cruises in western Lake Erie. The Hydra sampled all stations with a water depth greater than 4.0 meters. For shallow depth stations, a 21-foot Boston Whaler or a 23-foot Mako was dispatched from the R/V Hydra to obtain samples and return them to a shipboard laboratory for processing. In situ measurement for temperature, waves, transparency, extinction depth, aesthetics, dissolved oxygen, pH, and specific conductance were made from the Hydra and the smaller vessels. For all other water quality parameters samples were collected with either 5-liter Niskin bottles or a stainless steel submersible pump.

The analytical methods and instruments used to measure water, biotic and sediment parameters are given in Table 8. The range and detection limits for key water quality parameters are listed in Tables 9 and 10.

Biota

Whole water samples for phytoplankton analysis were obtained using a submersible pump aboard the R/V Hydra (surface and bottom) and with Niskin bottles aboard the smaller vessels (surface only). Samples were preserved immediately with modified Lugol's iodine solution and retained for subsequent analysis. From 0.2 to 10 ml of sample water were concentrated in sedimentation chambers and counted by the Utermohl technique. A counting method was employed, utilizing different magnifications for counting net, nanno-, and ultraplankton. Counts are expressed as number of cells/ml, and in all cases cell numbers were determined. Identifications of phytoplankters were made to species whenever possible. Cell dimensions were recorded for biomass determinations; algal biomass is expressed as ug/l.

Samples for zooplankton analysis were obtained with a 64 u mesh oceanographic plankton net (0.5 meter diameter) towed vertically through the water column from 1.0 meters above the lake bottom to the water surface. The nets were fitted with internal and external flow meters to determine sampling efficiency. Samples were preserved with a 40 percent sugar-formalin solution after the plankters had first been relaxed with carbonated water. Zooplankton counts were made using a Wield M5 binocular dissecting microscope with 20X oculars and a 12.5X objective. Approximately 200 zooplankters were ennumerated per sample with indentification to species level whenever possible.

Macrobenthic organisms were collected by the use of a 23 x 23 cm Ponar dredge. The samples were sieved through a number 30 USGS standard sieve (0.91 mm openings). The material retained by the sieve was preserved with a 10 percent formalin solution. A solution of Rose Bengal and ethyl alcohol was added to each sample to stain the organisms and provide contrast with the substrate. To insure that all organisms were counted and that skewed results did not occur in favor of dominant species, all benthos were removed from the sample and placed in numbered vials of 70 percent ethanol for later identification. The contents of each vial were examined with the use of a dissecting microscope at magnifications from 15-30X. This stage of analysis was used to separate immature and mature oligochaetes and for the analysis of larger benthos (i.e., amphipods,

oligochaetes, leeches, etc.). Representative specimens of chironomid genera were wet mounted for examination of the head capsule. Adult oligochaetes were placed in an ascending alcohol series to prepare them for permanent slides. The specimens were run through a series of 70% ethanol for 24 hours, 95% ethanol for two hours, 100% ethanol for two hours and xylene for 12 hours, after which they were mounted in Permount. Identification was made using a compound microscope with special attention given to the taxonomic features of setae size and shape, and size and shape of penis sheath and head.

The water for microbial analysis was collected by a modified Zobell sampler and was analyzed for densities of total aerobic heterotrophs, fecal coliforms, fecal streptococci, and Pseudomonas aeruginosa. The membrane filter methods described in Standard Methods (1975, Sections 909 and 910 respectively) were utilized in the fecal coliform and fecal streptococci assays. The fecal coliform analysis was modified by eliminating rosalic acid (Presswood 1978) and adding 1.5% difco-bacto agar to the m-FC media. These modifications were employed to allow the storage of the media onboard, to improve recovery and to enable easier counting. Total aerobic heterotrophic bacteria were assayed by using the membrane filter technique described by Taylor and Geldreich (1978). The media used was Difco plate count agar and incubated for 48 hours at 20^{0}C.

Sediment

Sediment samples were obtained for the determination of solids, nutrients, trace elements, toxic organic compounds and grain size. A Ponar dredge (23 x 23 cm) was used to take surface sediment samples and 7 cm diameter gravity cover with plastic core tubing was used to obtain subsurface samples. Samples were analyzed using the methods indicated in Tables 8 and 10.

Laboratories

This project utilized six laboratories to analyze samples collected in the nearshore waters of western Lake Erie. The location of these laboratories in relation to the project site, their utilization, and accessibility to the project site are outlined below:

R/V Hydra.

Location:	Shipboard Laboratory, western Lake Erie
Utilization:	Time dependent nutrient chemistry, sample filtration, in situ measurements and standard limnological field determinations
Accessibility:	Laboratory operating on station at time of sampling.

F. T. Stone Laboratory.

Location:	South Bass Island in western Lake Erie.
Utilization:	Reagent preparation, container preparation, microbiology and vessel docking.
Accessibility:	Laboratory within project site; accessible by research vessel, university aircraft and road vehicles via ferry.

Water Resources Center.

Location:	Columbus Campus of Ohio State University, approximately 120 miles south of project site.
Utilization:	Non-time dependent nutrient chemistry, major ions, plankton analysis, chlorophyll, carbon analysis, and solids; computer/data acquisition system, preparation of data for STORET entry and sample storage.
Accessibility:	Laboratory 120 miles south of Lake Erie; accessible by road vehicles (2½ hours) and university aircraft (1 hour) from project site.

Geochemistry Laboratory and Environmental Sciences Laboratory.

Location:	Bowling Green State University in Bowling Green, Ohio, approximately 25 miles south of western Lake Erie.
Utilization:	Metals analysis in water and sediment, grain-size analysis and benthos identification.
Accessibility:	Laboratories 25 miles south of Toledo and 60 miles southwest of South Bass Island; accessible by road vehicles (1½ hours) and university aircraft (½ hour) from project site.

River Laboratory.

Location:	Heidelberg College in Tiffin, Ohio, approximately 35 miles south of western Lake Erie.
Utilization:	Industrial pollutants in water and sediment.
Accessibility:	Laboratory 35 miles south of Port Clinton; accessible by road vehicle (1 hour) and university aircraft (½ hour) from project site.

RECRA Research Laboratory.

Location:	Tonawanda, New York, approximately 5 miles east of eastern Lake Erie.
Utilization:	Pesticides and toxic organic substances analysis.
Accessibility:	Laboratory 200 miles east of project site; accessible by road vehicle (5 hours) and university aircraft (2 hours) from project site.

Quality Control

Quality control samples were collected at a frequency of approximately one to every seven environmental samples. A duplicate cast was made while on each QC station so that two surface and two bottom samples were collected. Each duplicate sample was split just prior to analysis and each portion was run according to normal procedure. The differences between splits was calculated and a standard deviation for each parameter, by basin, was calculated. For AutoAnalyzer parameters, filtered and unfiltered blanks and spikes were prepared daily. Verification tests of fecal coliforms, fecal streptococci and Pseudomonas were performed as described in Standard Methods, Sections 909 and 910 (Table 11). A summary

of the percent recovery for organic contaminants is presented in Table 12. A cruise by cruise summary of quality control results for key water quality parameters is presented in Table 13. A two-year summary of quality control results for metals in water is given in Table 14.

Data Analysis Procedures

Water quality data for all parameters was entered in the central computer system at The Ohio State University in preparation for transmittal to the STORET data system. Three levels of analysis are used to characterize the nearshore zone. The first method is to present cruise means, standard errors, sample size, maximum and minimum concentrations of each parameter and the locations at which these extremes occurred. The second level of analysis consists of a division of the nearshore into seven geographical areas referred to as reaches (Table 4). The third level of analysis is designed to compare inshore and offshore waters. This was accomplished by using transects and couplets of inshore and adjacent offshore stations (Tables 5 and 6; Figures 6 and 7). Historical trends are discussed for individual parameters where continuous records exist.

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TABLES

TABLE 1

PARAMETERS MEASURED FOR THE WESTERN BASIN NEARSHORE, WATER

Parameter - Water	Abbreviations	Storet No.
Temperature	Temp	00010
Wind		
Speed	Wind Spd	00035
Direction	Wind Dir	00040
Transparency, Secchi	Secchi	00078
Wave Height	Wave Ht	70222
Extinction Depth	Ext Depth	
Asthetics		
Turbidity	Turb	00076
Oxygen, Dissolved	D.O.	00300
pH	pH	00400
Conductance, Specific	Cond	00095
Alkalinity, Total	Alk	00410
Phosphorus		
Total	TP	00665
Total Dissolved	TDP	00666
Soluble Reactive	SRP	00671
Kjeldahl Nitrogen, Total	TKN	00625
Ammonia Nitrogen, Total	NH_3	00608
Nitrate + Nitrite Nitrogen, Total	NO_2+NO_3	00630
Silica, Dissolved Reactive	SRS	00955
Chloride	Cl	00940
Sulfate	SO_4	00945
Major Ions		
Calcium	Ca	00916
Magnesium	Mg	00927
Sodium	Na	00929
Potassium	K	00937
Heavy Metals		
Aluminum, Total	Al,t	01105
Aluminum, Dissolved	Al,d	01106
Cadmium, Total	Cd,t	01027
Cadmium, Dissolved	Cd,d	01025
Chromium, Total	Cr,t	01034
Chromium, Dissolved	Cr,d	01030
Copper, Total	Cu,t	01042
Copper, Dissolved	Cu,d	01040
Iron, Total	Fe,t	01045
Iron, Dissolved	Fe,d	01046

TABLE 1 CONT.

PARAMETERS MEASURED FOR THE WESTERN BASIN NEARSHORE, WATER

Parameter - Water	Abbreviations	Storet No.
Heavy Metals (continued)		
Lead, Total	Pb,t	01051
Lead, Dissolved	Pb,d	01049
Manganese, Total	Mn,t	01055
Manganese, Dissolved	Mn,d	01056
Nickel, Total	Ni,t	01067
Nickel, Dissolved	Ni,d	01065
Vanadium, Total	V,t	01087
Vanadium, Dissolved	V,d	01085
Zinc, Total	Zn,t	01092
Zinc, Dissolved	Zn,d	01090
Silver, Total	Ag,t	01077
Silver, Dissolved	Ag,d	01075
Arsenic, Total	As,t	01002
Mercury, Total	Hg,t	71900
Selenium, Total	Se,t	01147
Cyanide	Cn	00720
Phenol	Phenol	32730
Total Suspended Solids	TSS	00530
Volatile Solids	VS	00520
Organic Carbon		
Total	TOC	00680
Dissolved	DOC	00681
Particulate	POC	80102
Total Aerobic Heterotrophs	TAH	31749
Fecal Coliforms	FC	31616
Fecal Streptococci	FS	31673
Phytoplankton	Phyto	
Zooplankton	Zoo	
Chlorophyll *a* corrected	Chl *a* corr	32211
Chlorophyll *a* SCOR/UNESCO	Chl *a*	32210
Pheophytin	Pheo	32218

TABLE 2

PARAMETERS MEASURED FOR THE WESTERN BASIN NEARSHORE, SEDIMENTS

Parameter - Sediment	Abbreviations	Storet No.
Solids (%)		70318
Solids (%), Volatile		70322
Chemical Oxygen Demand	COD	00339
Carbon, Total Organic	TOC	80149
Phosphorus, Total	TP	00668
Kjeldahl Nitrogen, Total	TKN	00627
Ammonia Nitrogen	NH_3	00611
Arsenic	As	01003
Selenium	Se	01148
Heavy Metals		
Cadmium	Cd	01028
Chromium	Cr	01029
Copper	Cu	01039
Iron	Fe	01018
Lead	Pb	01052
Nickel	Ni	01068
Silver	Ag	01078
Zinc	Zn	01093
Mercury	Hg	71921
Cyanide	Cn	00721
Size Analysis		
Organochlorine Scan		
Total PCBs		39519
Hexachlorobenzene		39701
Beta Benzenehexachloride		---
Lindane		---
Treflan		81618
Aldrin		34680
Isodrin		39433
Heptachlor epoxide		39423
Chlordane		39351
DDT and isomers		39359
Methoxychlor		39481
Mirex		39758
Isopropyl ester of 2, 4-D		---
Endosulfan I		34364
Endosulfan II		34359
Dieldrin		39383
Endrin		---
Tetradifon		81620
Macroinvertebrate Analysis		

TABLE 3

LAKE ERIE WESTERN BASIN NEARSHORE STATION LOCATIONS

Station No.	Latitude (°N)	Longitude (°W)	Depth (M)	No. of Depths Sampled	Description
M1	42° 01' 48"	83° 11' 30"	2.0	1	Between mouths of Detroit and Huron River
M2	42° 01' 00"	83° 12' 00"	2.0	1	Mouth of Mouillee Creek
M3	41° 59' 54"	83° 11' 30"	4.5	1	Between new dredge spoil and discontinued spoil area off Point Mouillee
M4	41° 58' 30"	83° 14' 36"	1.8	1	Mouth of Swan Creek Near Enricho Fermi Power Plant
M5	41° 58' 12"	83° 13' 06"	6.8	2	South of Point Mouillee new dredge spoil area
M6	41° 57' 42"	83° 11' 42"	6.9	2	Southeast of Point Mouillee new dredge spoil area
M7	41° 56' 30"	83° 15' 30"	3.0	1	Near Stoney Point
M8	41° 56' 12"	83° 14' 18"	7.5	2	Over Stoney Point Crib
M9	41° 55' 48"	83° 13' 00"	8.7	2	South of Point Mouillee new dredge spoil and east of Stoney Point
M10	41° 56' 24"	83° 18' 06"	1.7	1	Mouth of Stoney Creek in Brest Bay
M11	41° 55' 24"	83° 19' 24"	1.7	1	Mouth of Sandy Creek
M12	41° 53' 24"	83° 19' 54"	7.5	2	Mouth of River Raisin. Problem Area

TABLE 3 CONT.

LAKE ERIE WESTERN BASIN NEARSHORE STATION LOCATIONS

Station No.	Latitude (°N)	Longitude (°W)	Depth (M)	No. of Depths Sampled	Description
M13	41° 53' 12"	83° 19' 12"	8.1	2	Monroe Channel
M14	41° 52' 48"	83° 17' 48"	8.0	2	Monroe Channel
M15	41° 52' 30"	83° 16' 24"	8.0	2	Monroe Channel
M16	41° 52' 24"	83° 20' 54"	2.5	1	Mouth of the Monroe Power Plant effluent. Problem Area
M17	41° 52' 06"	83° 22' 42"	1.8	1	Mouth of LaPlaisance Creek
M18	41° 50' 42"	83° 23' 48"	1.5	1	Mouth of Otter Creek
M19	41° 50' 24"	83° 22' 12"	6.0	2	East of Otter Creek
M20	41° 50' 00"	83° 20' 48"	7.0	2	East of Otter Creek
M21	41° 49' 42"	83° 19' 30"	7.5	2	East of Otter Creek
M22	41° 49' 42"	83° 24' 30"	3.5	1	Mouth of Muddy Creek Mouth of Sulphur Creek
M23	41° 46' 24"	83° 26' 12"	1.2	1	Middle of Woodtick Peninsula
M24	41° 47' 06"	83° 24' 48"	5.3	2	East of Consumer Power Company Plant
M25	41° 47' 54"	83° 23' 00"	6.4	2	Northeast of Consumer Power Company Plant
M26	41° 44' 54"	83° 25' 30"	1.4	1	Near North Cape of east side Woodtick Peninsula
M27	41° 44' 36"	83° 27' 36"	2.0	1	Southwest of Indian Island Mouth of Ottawa River
01	41° 44' 00"	83° 27' 12"	1.8	1	Southwest of the mouth of the Ottawa River. Problem Area.

TABLE 3 CONT.

LAKE ERIE WESTERN BASIN NEARSHORE STATION LOCATIONS

Station No.	Latitude (°N)	Longitude (°W)	Depth (M)	No. of Depths Sampled	Description
02	41° 41' 48"	83° 28' 00"	10.2	2	Maumee Channel Southwest (200m) of Old Dredge Spoil Area. Problem Area.
03	41° 42' 42"	83° 26' 12"	10.8	2	Maumee Channel north of the new dredge spoil area. Problem Area.
04	41° 43' 30"	83° 24' 24"	10.8	2	Maumee Channel up channel from 03. Problem Area.
05	41° 44' 18"	83° 22' 36"	10.5	2	Maumee Channel up channel from 04.
06	41° 45' 12"	83° 20' 48"	11.2	2	Maumee Channel up channel from 05 southwest of the Toledo Harbor Light.
07	41° 46' 00"	83° 19' 00"	10.8	2	Maumee Channel up channel from 06
08	41° 41' 08"	83° 25' 48"	2.0	1	Toledo Edison's Bayshore Plant outfall Problem Area.
09	41° 41' 24"	83° 22' 36"	2.3	1	Maumee Bay near Cedar Point
010	41° 41' 54"	83° 20' 30"	2.0	1	Maumee Bay near the tip of Cedar Point
011	41° 42' 30"	83° 18' 24"	6.0	2	Near Toledo Northeast of Cedar Point
012	41° 41' 06"	83° 16' 42"	4.5	1	North of the Mouth of Cooley Creek
013	41° 42' 00"	83° 15' 30"	7.2	2	At Toledo Water Intake Crib
014	41° 38' 42"	83° 13' 12"	2.5	1	Between Ward Canal and Crane Creek
015	41° 36' 54"	83° 06' 12"	2.5	1	Mouth of Sand Creek
016	41° 36' 12"	83° 04' 36"	2.8	1	Davis Besse Nuclear Power Plant Outfall
017	41° 36' 24"	83° 04' 06"	5.0	2	Davis Besse Nuclear Power Plant Intake

TABLE 3 CONT.

LAKE ERIE WESTERN BASIN NEARSHORE STATION LOCATIONS

Station No.	Latitude (°N)	Longitude (°W)	Depth (M)	No. of Depths Sampled	Description
018	41° 36' 42"	83° 04' 36"	5.4	2	North of Davis Besse Nuclear Power Plant Intake
019	41° 37' 06"	83° 03' 00"	5.6	2	North of Davis Besse Nuclear Power Plant Intake
020	41° 37' 24"	83° 02' 24"	5.9	2	North of Davis Besse Nuclear Power Plant Intake
021	41° 35' 12"	83° 03' 36"	1.8	1	Mouth of the Toussaint River
022	41° 31' 24"	82° 57' 30"	2.3	1	West of Port Clinton Harbor Entrance
023	41° 31' 24"	82° 56' 24"	2.9	1	Northeast of Port Clinton Harbor Breakwall
024	41° 32' 18"	82° 56' 06"	7.1	2	North of Port Clinton Harbor Breakwall
025	41° 34' 30"	82° 56' 00"	8.0	2	North of Port Clinton Harbor Breakwall
026	41° 31' 12"	82° 54' 42"	2.0	1	East of Port Clinton Harbor Breakwall
027	41° 33' 24"	82° 47' 48"	5.9	2	East of Catawba Island near Middle Harbor
028	41° 34' 48"	82° 45' 36"	8.1	2	Southwest of Kelley's Island
029	41° 27' 42"	82° 57' 54"	1.7	1	Sandusky Bay just off Muddy Creek Bay
030	41° 25' 24"	82° 55' 54"	1.5	1	Southwest corner of Sandusky Bay
031	41° 28' 00"	82° 53' 00"	2.3	1	Sandusky Bay west of bridge
032	41° 29' 00"	82° 48' 36"	5.0	1	Sandusky Bay east of the Bay Bridge
033	41° 27' 00"	82° 46' 00"	2.5	1	Sandusky Bay near Venice Crib
034	41° 27' 12"	82° 44' 24"	3.0	1	Sandusky Bay west of the Coal Docks. Problem Area

TABLE 3 CONT.

LAKE ERIE WESTERN BASIN NEARSHORE STATION LOCATIONS

Station No.	Latitude (°N)	Longitude (°W)	Depth (M)	No. of Depths Sampled	Description
035	41° 28' 30"	82° 44' 18"	4.0	1	Sandusky Bay South of Johnson Island
036	41° 32' 00"	82° 42' 12"	10.0	2	East of Marblehead
037	41° 29' 30"	82° 41' 48"	14.5	2	Mouth of Sandusky Bay between Bay Point and Cedar Point
038	41° 30' 00"	82° 40' 30"	10.2	2	Entrance to Mosely Channel, Sandusky
039	41° 30' 48"	82° 38' 36"	12.3	2	Northeast of Sandusky Bay
040	41° 27' 48"	82° 38' 36"	9.3	2	Near Sandusky Water Intake Crib (Submerged)
041	41° 24' 42"	82° 35' 06"	2.5	1	Near Huron Water Intake Crib (Submerged)
042	41° 24' 36"	82° 35' 06"	9.0	2	Between Sandusky and Huron
043	41° 24' 18"	82° 33' 24"	6.8	2	West of Huron Breakwall near dredge spoil area.
044	41° 24' 00"	82° 32' 54"	9.4	2	Mouth of the Huron River
045	41° 24' 30"	82° 32' 12"	10.2	2	North of the Huron River Mouth
046	41° 25' 30"	82° 32' 12"	12.1	2	North of Huron Breakwall
047	41° 25' 36"	82° 32' 12"	13.0	2	Northeast of Huron Breakwall Southeast of Huron Dumping Ground
048	41° 23' 06"	82° 30' 42"	3.0	1	Mouth of Old Woman Creek
049	41° 24' 30"	82° 30' 42"	11.2	2	Northeast of Old Woman Creek Between Old Woman Creek and Cranberry Creek
050	41° 25' 36"	82° 30' 42"	12.7	2	Between Huron and Vermilion

TABLE 4

NEARSHORE REACHES AND STATIONS FOR
WESTERN LAKE ERIE: MICHIGAN AND OHIO

Reach No.	Location	Stations		
		Nearshore (All Stations)	Inshore	Offshore
1	Detroit River to Brest Bay	M-1 thru M-11	M-1, 2, 4, 7, 10, and 11	M-3, 6 and 9
2	Brest Bay to Maumee Bay	M-11 thru M-25	M-11, 12, 16, 17, 18, 22 and 23	M-15, 21 and 25
3	Maumee Bay	M-23 thru M-27; O-1 thru O-13	M-23, 26 and 27; O-1, 2, 8, 9, 10, 11 and 12	M-25; O-7 and 13
4	Maumee Bay to Toussaint River	O-12 thru O-21	O-12, 14, 15, 16 and 21	O-13 and 20
5	Toussaint River to Sandusky Bay	O-21 thru O-28	O-21, 22, 23, 26 and 27	O-25 and 28
6	Sandusky Bay	O-27 thru O-40	O-27, 29, 30, 33, 34, 36, 37 and 40	O-28, 31, 32, 35 and 39
7	Sandusky Bay to Old Woman Creek	O-40 thru O-50	O-40, 41, 43, 44 and 48	O-42, 47 and 50

TABLE 5

TRANSECTS WITHIN NEARSHORE REACHES OF
WESTERN LAKE ERIE: MICHIGAN AND OHIO

Cross-Section	Reach No.	Stations in Transect	Location	Direction
1	1	M-1, 3, 6 and 9	Detroit River Mouth to Stony Point	North to South
2	2	M-16, 20, 25, 24 and 23	River Raisin Mouth to Woodtick Pen.	North to South
3	3	O-2, 3, 4, 5, 6 and 7	Maumee River Mouth and Bay	Southwest to Northeast
4	4	O-21, 16, 17, 18, 19 and 20	Locust Point	South to North
5	5	O-23, 24 and 25	Portage River Mouth	South to North
6	6	O-29, 31, 32, 35, 37, 38 and 39	Sandusky Bay	West to East
7	7	O-44, 45, 46 and 47	Huron River Mouth	South to North

TABLE 6

WESTERN BASIN NEARSHORE INSHORE-OFFSHORE COUPLETS

INSHORE STATION	OFFSHORE STATION
M1	M3
M1	M6
M7	M9
M16	M15
M18	M21
M23	M25
M26	07
01	07
02	07
08	07
09	07
011	07
016	020
021	025
027	028
036	039
029	039
041	042
044	047
048	050

TABLE 7

NEARSHORE LAKE ERIE WESTERN BASIN 1978-1979 SAMPLING SCHEME

Parameter	Cruises	Stations	Runs	Depths	Sampling Horizons/yr., incl. QC Station	Percent QC
Water Measurements						
Temperature	1-4	77	1-3	S, B	1680	17
Wind Speed and Direction	1-4	77	1-3	S	1068	13
Secchi Depth	1-4	77	1-3	S	1068	13
Wave Height	1-4	77	1-3	S	1068	13
Extinction Depth	1-4	77	1-3	S	1068	13
Aesthetics	1-4	77	1-3	S	1068	13
Turbidity	1-4	77	1-3	S, B	1680	17
Suspended Solids	1-4	77	1	S	356	13
Dissolved Oxygen	1-4	77	1-3	S, B	1680	17
pH	1-4	77	1-3	S, B	1680	17
Spec. Conductance	1-4	77	1-3	S, B	1680	17
Alkalinity	1-4	77	1-3	S, B	1680	17
Total Phosphorus	1-4	77	1-3	S, B	1680	17
Total Dissolved Phosphorus	1-4	77	1-3	S, B	1680	17
Soluble Reactive Phosphorus	1-4	77	1-3	S, B	1680	17
Total Kjeldahl Nitrogen	1-4	77	1-3	S, B	1680	17
Ammonia	1-4	77	1-3	S, B	1680	17
Nitrate & Nitrite N	1-4	77	1-3	S, B	1680	17
Dissolved Reactive Silicate	1-4	77	1-3	S, B	1680	17
Chloride	1-4	77*	1-3	S, B	1680	17
Sulfate	1-4	77*	1-3	S, B	1680	17
Calcium	1-4	77	1	S	356	13

TABLE 7 CONT.

NEARSHORE LAKE ERIE WESTERN BASIN 1978-1979 SAMPLING SCHEME

Parameter	Cruises	Stations	Runs	Depths	Sampling Horizons/yr., incl. QC Station	Percent QC
Water Measurements (Cont)						
Magnesium	1-4	77	1	S	356	13
Sodium	1-4	77	1	S	356	13
Potassium	1-4	77	1	S	356	13
Aluminum, Total	1-4	77	1	S	356	13
Aluminum, Dissolved	1-4	77	1	S	356	13
Cadmium, Total	1-4	77	1	S	356	13
Cadmium, Dissolved	1-4	77	1	S	356	13
Chromium, Total	1-4	77	1	S	356	13
Chromium, Dissolved	1-4	77	1	S	356	13
Copper, Total	1-4	77	1	S	356	13
Copper, Dissolved	1-4	77	1	S	356	13
Iron, Total	1-4	77	1	S	356	13
Iron, Dissolved	1-4	77	1	S	356	13
Lead, Total	1-4	77	1	S	356	13
Lead, Dissolved	1-4	77	1	S	356	13
Manganese, Total	1-4	77	1	S	356	13
Manganese, Dissolved	1-4	77	1	S	356	13

TABLE 7 CONT.

NEARSHORE LAKE ERIE WESTERN BASIN 1978-1979 SAMPLING SCHEME

Parameter	Cruises	Stations	Runs	Depths	Sampling Horizons/yr., incl. QC Station	Percent QC
Water Measurements (Cont)						
Nickel, Total	1-4	77	1	S	356	13
Nickel, Dissolved	1-4	77	1	S	356	13
Vanadium, Total	1-4	77	1	S	356	13
Vanadium, Dissolved	1-4	77	1	S	356	13
Zinc, Total	1-4	77	1	S	356	13
Zinc, Dissolved	1-4	77	1	S	356	13
Arsenic, Total	1-4	77	1	S	356	14
Mercury, Total	1-4	77	1	S	356	13
Selenium, Total	1-4	77	1	S	356	13
Silver, Total	1-4	77	1	S	356	13
Silver, Dissolved	1-4	77	1	S	356	13
Cyanide	1-4	8(Sp)	1	S, B	56	14
Phenol	1-4	8(Sp)	1	S, B	56	14
Total Organic Carbon	1-4	77	1	S	356	14
Dissolved Organic Carbon	1-4	77	1	S	356	14

TABLE 7 CONT.

NEARSHORE LAKE ERIE WESTERN BASIN 1978-1979 SAMPLING SCHEME

Parameter	Cruises	Stations	Runs	Depths	Sampling Horizons/yr., incl. QC Station	Percent QC
Biological Measurements						
Phytoplankton	1-4	77*	1	S, B	456	17
Zooplankton	1-4	77*	1	B-S	308	14
Chlorophyll a	1-4	77	1-3	S, B	1680	17
Pheophytin	1-4	77	1-3	S, B	1680	17
Aerobic Heterotrophs	1-4	77	1-3	S, B	1680	13
Fecal Coliforms	1-4	77	1	S	267	13
Fecal Streptococci	1-4	77	1	S	267	13
Benthos	1-2*	77	1	B grab	89	13

*Reduction in the number of samples taken in 1979 to six stations

S = Surface
B = Bottom
Sp = Special Station, potential problem areas
QC = Quality Control

TABLE 7 CONT.

NEARSHORE LAKE ERIE WESTERN BASIN 1978-1979 SAMPLING SCHEME

Parameter	Cruises	Stations	Runs	Sample Type	Subsections of Sample	Sampling Horizons/ yr. incl. QC Station	Percent
Sediment Measurements							
Solids, Total	1	77	1	core	3	267	13
Solids, Volatile	1	77	1	core	3	267	13
Chemical Oxygen Demand	1	77	1	core	3	267	13
Total Organic Carbon	1	77	1	core	3	267	13
Total Phosphorus	1	77	1	core	3	267	13
Total Kjehdahl Nitrogen	1	77	1	core	3	267	13
Ammonia Nitrogen	1	77	1	core	3	267	13
Arsenic	1	77	1	core	3	267	13
Selenium	1	77	1	core	3	267	13
Cadmium	1	77	1	core	3	267	13
Chromium	1	77	1	core	3	267	13
Copper	1	77	1	core	3	267	13
Iron	1	77	1	core	3	267	13
Lead	1	77	1	core	3	267	13
Nickel	1	77	1	core	3	267	13
Silver	1	77	1	core	3	267	13

TABLE 7 CONT.

NEARSHORE LAKE ERIE WESTERN BASIN 1978-1979 SAMPLING SCHEME

Parameter	Cruises	Stations	Runs	Sample Type	Subsections of Sample	Sampling Horizons/ yr. incl. QC Station	Percent QC
Sediment Measurements (continued)							
Zinc	1	77	1	core	3	267	13
Mercury	1	77	1	core	3	267	13
Cyanide	1	77	1	core	3	267	13
PCBs, Total	1	77	1	core	3	267	13
Hexachlorobenzene	1	77	1	core	3	267	13
beta-Benzenehexa-chloride	1	77	1	core	3	267	13
Lindane	1	77	1	core	3	267	13
Treflan	1	77	1	core	3	267	13
Aldrin	1	77	1	core	3	267	13
Isodrin	1	77	1	core	3	267	13
Heptachlor Epoxide	1	77	1	core	3	267	13
Chlordane	1	77	1	core	3	267	13
DDT + Isomers	1	77	1	core	3	267	13

TABLE 7 CONT.

NEARSHORE LAKE ERIE WESTERN BASIN 1978-1979 SAMPLING SCHEME

Parameter	Cruises	Stations	Runs	Sample Type	Subsections of Sample	Sampling Horizons/ yr. incl. QC Station	Percent QC
Sediment Measurements (continued)							
Methoxychlor	1	77	1	core	3	267	13
Mirex 2	1	77	1	core	3	267	13
4-D Isopropyl Ester	1	77	1	core	3	267	13
Endosulfan I	1	77	1	core	3	267	13
Endosulfan II	1	77	1	core	3	267	13
Dieldren	1	77	1	core	3	267	13
Endrin	1	77	1	core	3	267	13
Tetradifon	1	77	1	core	3	267	13
Grain-size analysis and geological description	1	77	1	grab + core	4	356	13

TABLE 8

ANALYTICAL PROCEDURES AND EQUIPMENT

A. WATER MEASUREMENTS

PARAMETER	ANALYTICAL PROCEDURE, INSTRUMENT
1. Temperature	InterOcean, Martek (thermistor)
2. Wind speed and direction	Anemometer
3. Transparency, Secchi	Secchi disc
4. Wave height	Visual estimation
5. Extinction depth	Lamda meter
6. Aesthetics	Visual estimation
7. Turbidity	Hach Turbidimeter 2100
8. Suspended solids	GF/C glass fiber filter discs, Sartorius analytical balance
9. Dissolved oxygen	InterOcean, Martek-Electrode, Winkler
10. pH	InterOcean, Martek, Orion Electrode
11. Specific conductance	InterOcean, Martek, Beckman Electrode
12. Alkalinity	Methyl Orange Titrametric Analysis
13. Total phosphorus	AAII, Autoclaving $K_2S_2O_8+H_2SO_4 \cdot SnCl_2$ method
14. Total dissolved phosphorus	Digestion Autoclave, AAII $\cdot$ $SnCl_2$ method
15. Soluble reactive phosphorus	AAII $SnCl_2$ method
16. Total kjeldahl nitrogen	AAII Salicylate method
17. Ammonia	AAII phenate method
18. Nitrate & Nitrite N	AAII Cadmium reduction method
19. Dissolved reactive silicate	AAII Molybdosilicate-ascorbic-oxalic acid method
20. Chloride	AAII $Hg(SCN)_2$ + Fe + (III) method
21. Sulfate	AAII Methylthymol Blue method

TABLE 8 CONT.
ANALYTICAL PROCEDURES AND EQUIPMENT

A. WATER MEASUREMENTS

PARAMETER	ANALYTICAL PROCEDURE, INSTRUMENT
22. Calcium	Atomic Absorption
23. Magnesium	Atomic Absorption
24. Sodium	Atomic Absorption
25. Potassium	Atomic Absorption
26. Aluminum, total	Atomic Absorption
27. Aluminum, dissolved	Atomic Absorption (filtered)
28. Cadmium, total	Atomic Absorption
29. Cadmium, dissolved	Atomic Absorption (filtered)
30. Chromium, total	Atomic Absorption
31. Chromium, dissolved	Atomic Absorption (filtered)
32. Copper, total	Atomic Absorption
33. Copper, dissolved	Atomic Absorption (filtered)
34. Iron, total	Atomic Absorption
35. Iron, dissolved	Atomic Absorption (filtered)
36. Lead, total	Atomic Absorption
37. Lead, dissolved	Atomic Absorption (filtered)
38. Manganese, total	Atomic Absorption
39. Manganese, dissolved	Atomic Absorption (filtered)
40. Nickel, total	Atomic Absorption
41. Nickel, dissolved	Atomic Absorption (filtered)
42. Vanadium, total	Atomic Absorption
43. Vanadium, dissolved	Atomic Absorption (filtered)
44. Zinc, total	Atomic Absorption

TABLE 8 CONT.
ANALYTICAL PROCEDURES AND EQUIPMENT

A. WATER MEASUREMENTS CONT.

PARAMETER	ANALYTICAL PROCEDURE, INSTRUMENT
45. Zinc, dissolved	Atomic Absorption (filtered)
46. Arsenic, total	Atomic Absorption (Arsine, A-H_2 flame)
47. Mercury, total	Atomic Absorption (Manual cold vapor technique)
48. Selenium, total	Atomic Absorption (Selenium hydride, A-H_2 flame)
49. Silver, total	Atomic Absorption
50. Silver, dissolved	Atomic Absorption (filtered)
51. Cyanide	Distillation - colorimetry
52. Phenol	Atomic Absorption (4-AAP Method with distillation)
53. Total organic carbon	Dohrmann Envirotech DC-50 Carbon Analyzer
54. Disolved organic carbon	Dohrmann Envirotech DC-50 Carbon Analyzer

B. BIOLOGICAL MEASUREMENTS

1. Phytoplankton	Optical examination, Utermohl technique, Leitz/Wild inverted microscope
2. Zooplankton	Optical examination, Wild M5/M5A binocular dissecting microscope
3. Chlorophyll a	Acetone extinction, Varian Spectrophotometer
4. Pheophytin	Acetone extinction, Varian Spectrophotometer
5. Aerobic heterotrophs	Membrane filter, Bacto Plate Count Agar
6. Fecal coliforms	Membrane filter, Difco m-FC, Lauryl Tryptose Broth, E.C. Broth
7. Fecal streptococci	Membrane filter, KF Streptococcus agar
8. Benthos	Optical examination, binocular and compound microscopes

TABLE 8 CONT.
ANALYTICAL PROCEDURES AND EQUIPMENT
C. SEDIMENT MEASUREMENTS

PARAMETER	ANALYTICAL PROCEDURE, INSTRUMENT
1. Solids, total	Wet, dry weight
2. Solids, volatile	Dry, ash weight
3. Chemical oxygen demand	Dichromate reflux method
4. Total organic carbon	Persulfate digestion, IR detection
5. Total phosphorus	Spectrophotometer
6. Total kjeldahl nitrogen	AAII (continuous digestion)
7. Ammonia nitrogen	Distillation
8. Arsenic	Atomic Absorption
9. Selenium	Atomic Absorption
10. Cadmium	Atomic Absorption
11. Chromium	Atomic Absorption
12. Copper	Atomic Absorption
13. Iron	Atomic Absorption
14. Lead	Atomic Absorption
15. Nickel	Atomic Absorption
16. Silver	Atomic Absorption
17. Zinc	Atomic Absorption
18. Mercury	Atomic Absorption
19. Cyanide	Distillation
20. PCB's, total	Chromatography
21. Hexachlorobenzene	Chromatography
22. beta-Benzenehexachloride	Chromatography

TABLE 8 CONT.
ANALYTICAL PROCEDURES AND EQUIPMENT
C. SEDIMENT MEASUREMENTS CONT.

PARAMETER	ANALYTICAL PROCEDURE, INSTRUMENT
23. Lindane	Chromatography
24. Treflan	Chromatography
25. Aldrin	Chromatography
26. Isodrin	Chromatography
27. Heptachlor epoxide	Chromatography
28. Chlordane	Chromatography
29. DDT and isomers	Chromatography
30. Methoxychlor	Chromatography
31. Mirex 2	Chromatography
32. 4-D Isopropyl Ester	Chromatography
33. Endosulfan I	Chromatography
34. Endosulfan II	Chromatography
35. Dieldrin	Chromatography
36. Endrin	Chromatography
37. Tetradifon	Chromatography
38. Grain-size analysis	Settling tube 2 - 4 ϕ, pipet analysis 4 - 11 ϕ

TABLE 9

NEARSHORE PHYSIOCHEMICAL AND NUTRIENT METHODS FOR LAKE ERIE WESTERN BASIN

PARAMETER	METHOD	RANGE	DETECTION LIMIT	REFERENCE
Temperature	In situ probe <10 m BT >10 m	0-35°C 0-35°C	0.2°C 0.1°C	
Dissolved oxygen	In situ probe readings verified with one winkler on each station	0-14 mg/l	0.05 mg/l	Standard Methods, 1975
Conductivity	In situ probe Values corrected to 25°C	0-1000 µmhos/cm	NA	CCIW, 1974
pH	In situ probe	7-10	NA	Standard Methods, 1975
Alkalinity	Methyl Orange titrametric method Automated Methyl Orange method	0.9-250 mg/l 0.9-250 mg/l	0.9 mg/l 0.9 mg/l	Standard Methods, 1975 Technicon
Turbidity	Hach turbidity meter	0.1-200 ntu's	0.1 ntu's	EPA method 180.1
Secchi depth	30 cm whipple modified Secchi disc	.002-12 m	0.02 m	Clear Technical 205,1981
Extinction depth	Protomatic	.002-12 m	.002 m	Clear Technical 205,1981
Chlorophyll a corrected	Acetone extraction spectrophotometer	0.6-250 µg/l*	0.6 µg/l	Lorenzen, 1967
Pheophytin	Acetone extraction spectrophotometer	0.1-100 µg/l**	0.1 µg/l	Lorenzen, 1967
Chlorophyll a	Acetone extraction spectrophotometer	0.6-250 µg/l*	0.6 µg/l	SCOR/UNESCO, 1966
Fluoride	Selective ion electrode Orion pH meter	0.001-1 mg/l	0.001 mg/l	EPA method 340.2
Color	Chloroplatinate	0-50 Cl Pt	0.25 Cl Pt	Technicon Industrial Method 181-72 W
D.O.C.	Filtered water run on Dohrman-D.C. (52 S) Total Organic Carbon Analyzer	0.1-50 ppm	0.1 ppm	EPA method 415.1
P.O.C.	GFF Glass Fiber pad combusted by Perkin Elmer Elemental Analyzer 203	15-10,000 ppb*	15.4 ppb	CCIW, 1979
T.O.C.	Calculated-addition of D.O.C. to P.O.C.	NA	NA	NA
Suspended Solids	GF/C Glass Fiber pad weighed on electronic balance	0.2-1000 mg/l*	.2 mg/l	Standard Methods, 1975
Volatile Solids	GF/C Glass Fiber pad, ignited and weighed on electronic balance	0.2-1000 mg/l*	.2 mg/l	Standard Methods, 1975
Cyanide	Distillation-colorimetry	2-100 ppb	2 ppb	CCIW, 1979
Phenol	AAII 4-AAP with Distillation	10-500 ppb	10 ppb	EPA Method 420.2
Sulfate	AAII Methylthymol Blue	.2-50 ppm	.2 ppm	EPA Method 375.2 Storet No. 00945
Chloride	AAII Ferricyanide	.2-50 ppm	.2 ppm	Technicon Industrial Method 99-70 W modified by CLEAR
Nitrate-Nitrite	AAII Cadmium Reduction	.005-1.000 ppm	.005 ppm	Technicon Industrial Method 100-70 W
Ammonia	AAII Phenate	2-200 ppb 4-400 ppb	2.0 ppb 4.0 ppb	Technicon Industrial Method 154-71 W
Dissolved Reactive Silicate	AAII Molibdosilicate-ascorbic-oxalic acid	.03-5.00 ppm	.03 ppm	Technicon Industrial Method 186-72 W
Soluble Reactive Phosphorus	AAII Stannous Chloride	.5-100 ppb	.5 ppb	CCIW, 1979
Total Dissolved Phosphorus	AAII Stannous Chloride Persulfate + H_2SO_4 Autoclave Digestion	.5-100 ppb 1.0-200 ppb	.5 ppb 1.0 ppb	CCIW, 1979
Total Phosphorus	AAII Stannous Chloride - Persulfate + H_2SO_4 Digestion in Autoclave	.5-100 ppb 1.0-200 ppb	.5 ppb 1.0 ppb	CCIW, 1979
Total Kjeldahl Nitrogen	AAII continuous digestion Salicilate Method (1978)	50-1000 ppb	50 ppb	El Kei, 1978
	Semiautomated Block Digestion AAII Phenate Method (1979)	.5-10 ppm	.5 ppm	EPA Method 351.1

*It is possible to extend the range by increasing the amount of water filtered

**Negative values occur due to problems with the trichromatic equation

TABLE 10

NEARSHORE ATOMIC ABSORPTION METHODS
FOR LAKE ERIE WESTERN BASIN METALS

Parameter		Methods	Range*	Detection Limit	Reference
Aluminum	- total	NO_2-acetylene flame	0-5000 ppb	1.25 ppb	P.E. 1976(1)
	- dissolved	NO_2-acetylene flame	0-5000 ppb	1.25 ppb	P.E. 1976(1)
Arsenic	- total	Arsine hydride	0-225 ppb	6.00 ppb	P.E. 1978
Cadmium	- total	HGA	0-20 ppb	0.075 ppb	P.E. 1976(2)
	- dissolved	HGA	0-20 ppb	0.075 ppb	P.E. 1976(2)
Chromium	- total	HGA	0-200 ppb	1.25 ppb	P.E. 1976(2)
	- dissolved	HGA	0-200 ppb	1.25 ppb	P.E. 1976(2)
Copper	- total	HGA	0-100 ppb	1.5 ppb	P.E. 1976(2)
	- dissolved	HGA	0-100 ppb	1.5 ppb	P.E. 1976(2)
Iron	- total	air-acetylene flame	0-5000 ppb	0.75 ppb	P.E. 1976(1)
	- dissolved	HGA	0-200 ppb	0.75 ppb	P.E. 1976(2)
Lead	- total	HGA	0-100 ppb	0.5 ppb	P.E. 1976(2)
	- dissolved	HGA	0-100 ppb	0.5 ppb	P.E. 1976(2)
Manganese	- total	air-acetylene flame	0-1500 ppb	0.15 ppb	P.E. 1976(1)
	- dissolved	HGA	0-300 ppb	0.15 ppb	P.E. 1976(2)
Mercury	- total	Cold Vapor A	0-20 ppb	0.1 ppb	P.E. 1978
Nickel	- total	HGA	0-200 ppb	5 ppb	P.E. 1976(2)
	- dissolved	HGA	0-200 ppb	5 ppb	P.E. 1976(2)

TABLE 10 CONT.

NEARSHORE ATOMIC ABSORPTION METHODS
FOR LAKE ERIE WESTERN BASIN METALS

Parameter		Methods	Range*	Detection Limit	Reference
Selenium	- total	HGA w/Ni addition	0-100 ppb	2.5 ppb	P.E. 1976(2)
Silver	- total	HGA	0-25 ppb		P.E. 1976(2)
	- dissolved	HGA	0-25 ppb		P.E. 1976(2)
Vanadium	- total	HGA	0-300 ppb	19 ppb	P.E. 1976(2)
	- dissolved	HGA	0-300 ppb	19 ppb	P.E. 1976(2)
Zinc	- total	air-acetylene flame	0-1000 ppb	30 ppb	P.E. 1976(1)
	- dissolved	air-acetylene flame	0-1000 ppb	30 ppb	P.E. 1976(1)
Calcium	- total	air-acetylene w/La addition	0-5 ppm	0.003 ppm	P.E. 1976(1)
	- dissolved	air-acetylene w/La addition	0-5 ppm	0.003 ppm	P.E. 1976(1)
Magnesium	- total	air-acetylene w/La addition	0-1.5 ppm	0.005 ppm	P.E. 1976(1)
	- dissolved	air-acetylene w/La addition	0-1.5 ppm	0.005 ppm	P.E. 1976(1)
Potassium	- total	air-acetylene flame	0-1.5 ppm	0.005 ppm	P.E. 1976(1)
	- dissolved	air-acetylene flame	0-1.5 ppm	0.005 ppm	P.E. 1976(1)
Sodium	- total	air-acetylene flame	0-3 ppm	0.002 ppm	P.E. 1976(1)
	- dissolved	air-acetylene flame	0-3 ppm	0.002 ppm	P.E. 1976(1)

*It is possible to extend the working range by diluting the samples.

TABLE 11

MICROBIOLOGY VERIFICATION TESTS - SUMMARY
1978 and 1979
Ohio State University, CLEAR

	FECAL COLIFORM			FECAL STREPTOCOCCAL			PSEUDOMONAS	
	% VERIFICATION	% FALSE POSITIVES	% FALSE NEGATIVES	% VERIFICATION	% FALSE POSITIVES	% FALSE NEGATIVES	% VERIFICATION	% FALSE POSITIVES
Cr 1.78	56.0	35.0	14.0	87.5	12.5	ND	7.1	4.3
Cr 2.78	34.0	30.0	38.0	65.5	34.0	ND	6.6	3.3
Cr 3.78	29.7	11.9	11.9	35.0	65.0	ND	5.3	21.0
Cr 4.78	46.7	18.5	7.6	44.0	40.1	0.6	ND	ND
Cr 1.79	35.8	52.3	18.9	67.4	32.6	ND	ND	ND
Cr 2.79	39.0	59.0	7.0	76.0	24.0	ND	ND	ND
Cr 3.79	50.0	43.0	6.0	19.0	83.0	ND	ND	ND
Cr 4.79	ND	ND	ND	69.0	ND	ND	ND	ND

ND = No Data

$$\% \text{ Verification} = \frac{\text{No. of colonies meeting verification test}}{\text{No. of colonies subjected to verification test}} \times 100$$

$$\% \text{ False Positives} = \frac{\text{No. of colonies with correct color, wrong results}}{\text{No. of colonies with correct color}} \times 100$$

$$\% \text{ False Negatives} = \frac{\text{No. of colonies with wrong color, correct results}}{\text{No. of colonies with correct results}} \times 100$$

TABLE 12

ORGANIC CONTAMINANTS - SUMMARY OF PERCENT RECOVERY DATA - 1978 AND 1979

RECRA RESEARCH, INC.

PARAMETER	MEAN PERCENT RECOVERY
Hexachlorobenzene	33
β-Benzene Hexachloride	79
Lindane	73
Trifuralin	92
Aldrin	85
Heptachlor epoxide	90
Chlordane	38
Methoxychlor	81
Mirex	108
2,4-D Isopropyl Ester	93
Endosulfan I	110
Endosulfan II	95
Dieldrin	89
Endrin	104
o,p'-DDE	81
o,p'-DDD	91
o,p'-DDT	77
p',p'-DDT	71
Aroclor 1242	144

TABLE 13

QUALITY CONTROL SUMMARY - CRUISE 1, 1978

Results of Analysis of Replicates Data					
Parameter	No. of Pairs in Sample	No. of Pairs Rejected	Average Difference Between Pairs	Estimate of Std. Deviation	Working Range and Units
Temperature	147	3	0.240	0.210	4.86-16.20 (^{o}C)
D.O.	4	0	0.080	0.070	11.2-11.8 (mg/l)
Conductivity	250	0	8.700	7.700	117-290 (μmhos/cm)
pH	3	0	0.080	0.070	7.63-7.93
Alkalinity	12	0	1.100	0.980	80.6-155.9 mg/l as CaCO
Turbidity	8	0	1.800	1.600	6.8-58 (ntu)
Secchi	ND	ND	ND	ND	ND
Extinction Depth	ND	ND	ND	ND	ND
Chl a Corr.	7	0	0.880	0.780	3.05-15.57 (μg/l)
Fluoride	6	0	0.021	0.019	0.214-0.300 (mg/l)
d.o.c.	24	0	0.599	0.531	0.658-8.287 (ppm)
SRP	33	3	1.200	1.100	0-100 (ppb)
Ammonia	25	1	9.200	8.200	0-400 (ppb)
NO -NO	24	2	0.026	0.023	0-1 (ppm)
Silica	25	5	0.020	0.020	0-5 (ppm)
Chloride	13	0	0.200	0.200	0-50 (ppm)
Sulfate	16	3	0.200	0.200	0-50 (ppm)
TAH	4	0	1.1x10	9.8x10	3.3x10-4.7x10 (cells/ml)
F.S.	3	0	0.330	0.290	1-4 (cells/100 mls)
F.C.	3	0	16.700	14.800	1-38 (cells/100 mls)
Pseudomonas*	6	0	0.830	0.740	1-4 (cells/100 mls)

ND = No Data
*Calculated for year

TABLE 14

QUALITY CONTROL SUMMARY - CRUISE 2, 1978

Results of Analysis of Replicates Data					
Parameter	No. of Pairs in Sample	No. of Pairs Rejected	Average Difference Between Pairs	Estimate of Std. Deviation	Working Range and Units
Temperature	27	0	0.300	0.260	17.5-27.0 (^{o}C)
D.O.	19	0	0.18	0.16	4.2-9.3 (mg/l)
Conductivity	10	0	6.500	5.800	260-590 (μmhos/cm)
pH	38	0	0.030	0.030	7.74-9.06
Alkalinity	4	0	2.220	1.970	70.6-78.1 (mg/l as CaCO)
Turbidity	52	0	0.400	0.400	4-52 (ntu)
Secchi	17	0	13.700	12.100	20-158 (cm)
Extinction Depth	17	2	6.700	5.900	40-400 (cm)
Chl *a* Corr.	31	4	4.210	3.730	1.29-210.60 (μg/l)
Fluoride	8	0	0.029	0.026	0.116-0.480 (mg/l)
d.o.c.	4	0	0.400	0.355	2.467-5.934 (ppm)
SRP	57	4	0.300	0.200	0-100 (ppb)
Ammonia	92	4	1.400	1.200	0-400 (ppb)
NO -NO	54	0	0.002	0.002	0-1 (ppm)
Silica	45	4	0.020	0.020	0-5 (ppm)
Chloride	44	1	0.100	0.100	0-50 (ppm)
Sulfate	51	0	0.400	0.300	0-50 (ppm)
TAH	24	0	7.9x10	7.0x10	91-1.8x10 (cells/ml)
F.S.	8	0	12.600	11.200	1-100 (cells/100 mls)
F.C.	5	0	106.400	94.300	1-360 (cells/100 mls)

TABLE 15

QUALITY CONTROL SUMMARY - CRUISE 3, 1978

Results of Analysis of Replicates Data					
Parameter	No. of Pairs in Sample	No. of Pairs Rejected	Average Difference Between Pairs	Estimate of Std. Deviation	Working Range and Units
Temperature	20	1	0.040	0.039	21.5-25.4 (^{o}C)
D.O.	12	0	0.160	0.140	7.5-9.8 (mg/l)
Conductivity	23	0	2.300	2.000	232-485 (μmhos/cm)
pH	23	0	0.070	0.070	8.10-8.95
Alkalinity	36	0	0.930	0.820	59.5-83.5 (mg/l as CaCO)
Turbidity	68	0	0.200	0.200	5-27 (ntu)
Secchi	22	0	6.100	5.400	25-142 (cm)
Extinction Depth	24	0	25.500	22.600	45-400 (cm)
Chl *a* Corr.	35	0	4.240	3.760	8.16-124.98 (μg/l)
Fluoride	8	0	0.005	0.005	0.190-0.449 (mg/l)
d.o.c.	6	0	0.513	0.454	2.079-5.571 (ppm)
SRP	72	2	0.400	0.300	0-100 (ppb)
Ammonia	72	12	1.400	1.200	0-200 (ppb)
NO -NO	72	0	0.002	0.001	0-1 (ppm)
Silica	72	1	0.010	0.010	0-5 (ppm)
Chloride	16	0	0.050	0.040	0-50 (ppm)
Sulfate	60	0	0.200	0.200	0-50 (ppm)
TAH	35	0	3.2x10	2.84x10	70-2.9x10 (cells/ml)
F.S.	12	0	23.000	20.400	1-104 (cells/100 mls)
F.C.	8	0	105.600	93.600	1-7000 (cells/100 mls)

TABLE 16

QUALITY CONTROL SUMMARY - CRUISE 4, 1978

Results of Analysis of Replicates Data					
Parameter	No. of Pairs in Sample	No. of Pairs Rejected	Average Difference Between Pairs	Estimate of Std. Deviation	Working Range and Units
Temperature	23	1	0.016	0.014	9.1-17.4 (^{o}C)
D.O.	13	0	0.230	0.200	8.88-11.02 (mg/l)
Conductivity	27	1	2.400	2.100	160-308 (μmhos/cm)
pH	39	1	0.076	0.067	7.98-8.81
Alkalinity	36	0	1.710	1.510	79.1-104.7 (mg/l as CaCO)
Turbidity	75	0	0.700	0.600	4.8-54 (ntu)
Secchi	23	0	7.200	6.400	29-122 (cm)
Extinction Depth	23	0	8.500	7.500	55-418 (cm)
Chl *a* Corr.	28	0	2.050	1.820	7.46-92.86 (μg/l)
Fluoride	9	0	0.006	0.005	0.113-0.219 (mg/l)
d.o.c.	8	0	0.284	0.252	2.016-5.011 (ppm)
SRP	59	0	0.600	0.500	0-100 (ppb)
Ammonia	52	4	1.400	1.200	0-200 (ppb)
NO -NO	72	0	0.002	0.002	0-1 (ppm)
Silica	72	0	0.010	0.010	0-5 (ppm)
Chloride	66	0	0.100	0.100	0-50 (ppm)
Sulfate	76	3	0.500	0.400	0-50 (ppm)
TP	39	2	1.200	1.000	0-200 (ppb)
TFP	72	4	0.700	0.600	0-200 (ppb)
TKN	123	13	12.000	11.000	0-1000 (ppb)
TAH	32	0	8.6x10	7.6x10	50-1.6x10 (cells/ml)
F.S.	12	0	4.300	3.800	1-100 (cells/100 mls)
F.C.	7	0	132.000	117.000	1-5100 (cells/100 mls)

TABLE 17

QUALITY CONTROL SUMMARY - CRUISE 1, 1979

Results of Analysis of Replicates Data					
Parameter	No. of Pairs in Sample	No. of Pairs Rejected	Average Difference Between Pairs	Estimate of Std. Deviation	Working Range and Units
Temperature	20	0	0.040	0.030	2.6-9.0 (^{o}C)
D.O.	14	0	0.090	0.080	12.36-13.35 (mg/l)
Conductivity	20	1	2.700	2.400	285-600 (μmhos/cm)
pH	30	0	0.090	0.080	7.79-8.29
Alkalinity	33	0	0.860	0.760	56.0-152.1 (mg/l as CaCO)
Turbidity	17	2	2.200	2.000	6.0-52.0 (ntu)
Secchi	12	0	5.000	4.400	5.0-80 (cm)
Extinction Depth	22	0	20.900	18.500	5.0-589 (cm)
Chl a Corr.	12	0	1.690	1.500	6.9-23.0 (μg/l)
Fluoride	ND	ND	ND	ND	ND
d.o.c.	ND	ND	ND	ND	ND
SRP	68	1	0.500	0.400	0-100 (ppb)
Ammonia	77	5	2.400	2.100	0-200 (ppb)
NO -NO	69	7	0.008	0.007	0-1 (ppm)
Silica	72	1	0.020	0.010	0-5 (ppm)
Chloride	ND	ND	ND	ND	ND
Sulfate	ND	ND	ND	ND	ND
TAH	35	0	1.5x10	1.3x10	1.0x10 - 2.8x10 (cells/ml)
F.S.	12	0	448.000	398.000	1-6.2x10 (cells/100 mls)
F.C.	12	0	152.000	135.000	1-4.7x10 (cells/100 mls)

ND = No Data

TABLE 18

QUALITY CONTROL SUMMARY - CRUISE 2, 1979

Results of Analysis of Replicates Data					
Parameter	No. of Pairs in Sample	No. of Pairs Rejected	Average Difference Between Pairs	Estimate of Std. Deviation	Working Range and Units
Temperature	20	0	0.040	0.030	23.7-25.2 (^{o}C)
D.O.	10	3	0.190	0.170	7.04-9.45 (mg/l)
Conductivity	20	0	2.800	2.500	230-530 (μmhos/cm)
pH	42	0	0.070	0.060	8.05-9.39
Alkalinity	32	1	1.970	1.740	85.0-116.2 (mg/l as CaCO)
Turbidity	41	1	1.300	1.100	1.8-51 (ntu)
Secchi	20	1	7.100	6.300	20-192 (cm)
Extinction Depth	24	0	24.300	21.500	50-550 (cm)
Chl *a* Corr.	21	3	4.950	4.140	2.60-67.84 (μg/l)
Fluoride	ND	ND	ND	ND	ND
d.o.c.	ND	ND	ND	ND	ND
SRP	71	0	0.600	0.500	0-100 (ppb)
Ammonia	73	3	2.200	2.000	0-200 (ppb)
NO -NO	71	2	0.005	0.004	0-1 (ppm)
Silica	66	0	0.010	0.007	0-5 (ppm)
Chloride	ND	ND	ND	ND	ND
Sulfate	ND	ND	ND	ND	ND
TAH	36	0	456.000	404.000	40-1.0x10 (cells/ml)
F.S.	12	0	5.300	4.700	1-47 (cells/100 mls)
F.C.	12	0	24.000	21.000	1-504 (cells/100 mls)

ND = No Data

TABLE 19

QUALITY CONTROL SUMMARY - CRUISE 3, 1979

Results of Analysis of Replicates Data					
Parameter	No. of Pairs in Sample	No. of Pairs Rejected	Average Difference Between Pairs	Estimate of Std. Deviation	Working Range and Units
Temperature	19	1	0.060	0.050	15.8-22.6 (^{o}C)
D.O.	14	2	0.120	0.110	7.09-10.31 (mg/l)
Conductivity	22	1	4.100	3.600	215-485 (μmhos/cm)
pH	62	0	0.080	0.070	8.33-9.33
Alkalinity	36	0	3.440	3.050	80.2-143.0 (mg/l as CaCO)
Turbidity	67	1	1.500	1.300	8-60 (ntu)
Secchi	23	2	5.400	4.800	10-82 (cm)
Extinction Depth	23	0	13.300	11.800	48-233 (cm)
Chl a Corr.	25	2	3.890	3.450	15.77-117.95 (μg/l)
Fluoride	ND	ND	ND	ND	ND
d.o.c.	ND	ND	ND	ND	ND
SRP	51	2	0.450	0.390	0-100 (ppb)
Ammonia	30	0	1.600	1.400	0-100 (ppb)
NO -NO	38	0	0.003	0.003	0-1 (ppm)
Silica	66	0	0.013	0.012	0-5 (ppm)
Chloride	ND	ND	ND	ND	ND
Sulfate	ND	ND	ND	ND	ND
TAH	27	0	2.0x10	1.8x10	3.0x10 - 5.1x10 (cells/ml)
F.S.	12	0	24.500	21.700	1-180 (cells/100 mls)
F.C.	12	0	7.000	7.000	1-530 (cells/100 mls)

ND = No Data

TABLE 20

QUALITY CONTROL SUMMARY - CRUISE 4, 1979

Results of Analysis of Replicates Data					
Parameter	No. of Pairs in Sample	No. of Pairs Rejected	Average Difference Between Pairs	Estimate of Std. Deviation	Working Range and Units
Temperature	23	0	0.030	0.020	9.1-14.4 (^{o}C)
D.O.	21	3	0.190	0.170	8.9-12.2 (mg/l)
Conductivity	24	0	3.600	3.200	152-320 (μmhos/cm)
pH	66	0	0.100	0.090	8.06-9.42
Alkalinity	36	0	2.390	2.120	82.1-133.5 (mg/l as CaCO)
Turbidity	72	0	1.600	1.400	1.9-60 (ntu)
Secchi	22	1	7.100	6.300	27-136 (cm)
Extinction Depth	24	0	23.300	20.700	60-537 (cm)
Chl a Corr.	27	0	1.880	1.660	10.65-89.11 (μg/l)
Fluoride	ND	ND	ND	ND	ND
d.o.c.	ND	ND	ND	ND	ND
SRP	47	2	0.500	0.400	0-100 (ppb)
Ammonia	45	4	2.000	1.800	0-100 (ppb)
NO -NO	78	0	0.003	0.002	0-1 (ppm)
Silica	72	0	0.011	0.010	0-5 (ppm)
Chloride	ND	ND	ND	ND	ND
Sulfate	ND	ND	ND	ND	ND
TP*	45	5	1.200	1.000	0-200 (ppb)
TKN*	36	1	0.044	0.039	0-10 (ppm)
TFP*	ND	ND	ND	ND	0-200 (ppb)
TAH	30	0	213.000	189.000	1-2.1x10 (cells/ml)
F.S.	12	0	9.200	8.200	1-50 (cells/100 mls)
F.C.	10	0	13.000	12.000	1-2.9x10 (cells/100 mls)

*1979 yearly averages
ND = No Data

TABLE 21

METALS IN WATER QUALITY CONTROL SUMMARY - 1978 & 1979

Parameter	No. of Pairs in Sample	No. of Pairs Rejected	Average Difference Between Pairs	Estimate of Std. Deviation	Working Range and Units	T*	W**
Aluminum							
Total	55	1	71.60	63.44	0-5000 ppb	199.12	30.00
Dissolved	18	5	30.04	26.63	0-5000 ppb	199.12	30.00
Arsenic							
Total	2	0	0.85	0.75	0-225 ppb	1.56	0.30
Cadmium							
Total	26	0	1.58	1.40	0-20 ppb	0.12	0.02
Dissolved	13	2	0.12	0.11	0-20 ppb	0.12	0.02
Chromium							
Total	6	0	18.69	16.57	0-200 ppb	0.26	0.03
Dissolved	20	1	0.08	0.07	0-200 ppb	0.25	0.03
Copper							
Total	24	0	9.08	8.05	0-100 ppb	4.62	0.70
Dissolved	22	0	0.82	0.73	0-100 ppb	4.62	0.70
Iron							
Total	39	2	88.43	78.39	0-5000 ppb	41.46	6.00
Dissolved	17	1	3.85	3.41	0-200 ppb	5.30	0.90

TABLE 21 CONT.

METALS IN WATER QUALITY CONTROL SUMMARY - 1978 & 1979

Parameter	No. of Pairs in Sample	No. of Pairs Rejected	Average Difference Between Pairs	Estimate of Std. Deviation	Working Range and Units	T*	W**
Lead							
Total	25	0	1.55	1.38	0-100 ppb	7.14	0.80
Dissolved	84	2	0.99	0.88	0-100 ppb	2.00	0.80
Mercury							
Total	9	1	0.06	0.05	0-20 ppb	0.11	0.02
Manganese							
Total	118	12	12.57	11.14	0-1500 ppb	1.48	0.20
Dissolved	29	4	0.56	0.50	0-300 ppb	1.40	0.20
Nickel							
Total	99	3	20.44	18.12	0-200 ppb	16.00	2.00
Dissolved	11	1	0.50	0.45	0-200 ppb	7.20	0.90
Selenium							
Total	67	2	10.45	9.26	0-100 ppb	23.66	4.00
Silver							
Total	25	3	0.24	0.19	0-25 ppb	2.25	2.00
Dissolved	15	0	0.03	0.02	0-25 ppb	2.25	0.20

TABLE 21 CONT.

METALS IN WATER QUALITY CONTROL SUMMARY - 1978 & 1979

Parameter	No. of Pairs in Sample	No. of Pairs Rejected	Average Difference Between Pairs	Estimate of Std. Deviation	Working Range and Units	T*	W**
Vanadium							
Total	19	0	1.69	1.50	0-300 ppb	6.82	0.700
Dissolved	42	0	3.09	2.74	0-300 ppb	6.82	0.700
Zinc							
Total	27	0	7.00	6.21	0-1000 ppb	24.85	4.000
Dissolved	11	1	8.42	7.46	0-1000 ppb	24.85	0.400
Calcium							
Total	133	0	7.51	6.66	0-5 ppm	2.37	0.400
Dissolved	30	2	0.09	0.08	0-5 ppm	2.37	0.400
Magnesium							
Total	119	0	8.20	7.27	0-1.5 ppm	0.02	0.004
Dissolved	31	1	0.04	0.04	0-1.5 ppm	0.02	0.004
Potassium							
Total	33	2	0.02	0.01	0-1.5 ppm	0.41	0.030
Dissolved	11	0	0.01	0.01	0-1.5 ppm	0.41	0.030
Sodium							
Total	27	0	0.12	0.11	0-3 ppm	1.53	0.200
Dissolved	18	5	0.07	0.07	0-3 ppm	1.53	0.100

*T = value reported is less than criterion of detection. Any data point equivalent to the T values listed, in the judgement of this laboratory do not differ significantly from zero. IJC 1980.

**W = Value reported is less than lowest value reportable under T code (smallest value that can be read on the analytical device). IJC 1980.

FIGURES

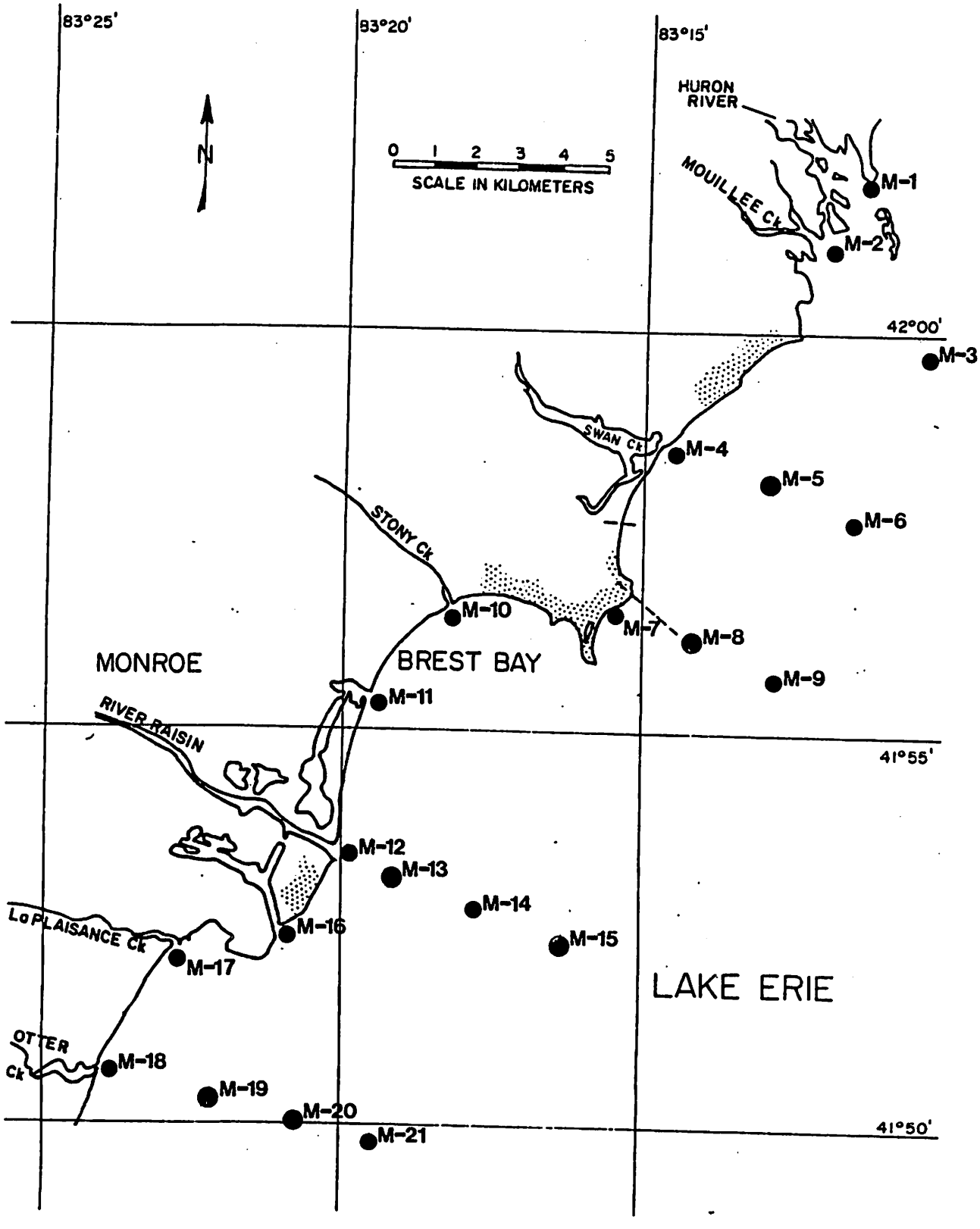

Figure 1. Nearshore Western Basin Station Map - Detroit River, Michigan to Otter Creek, Michigan.

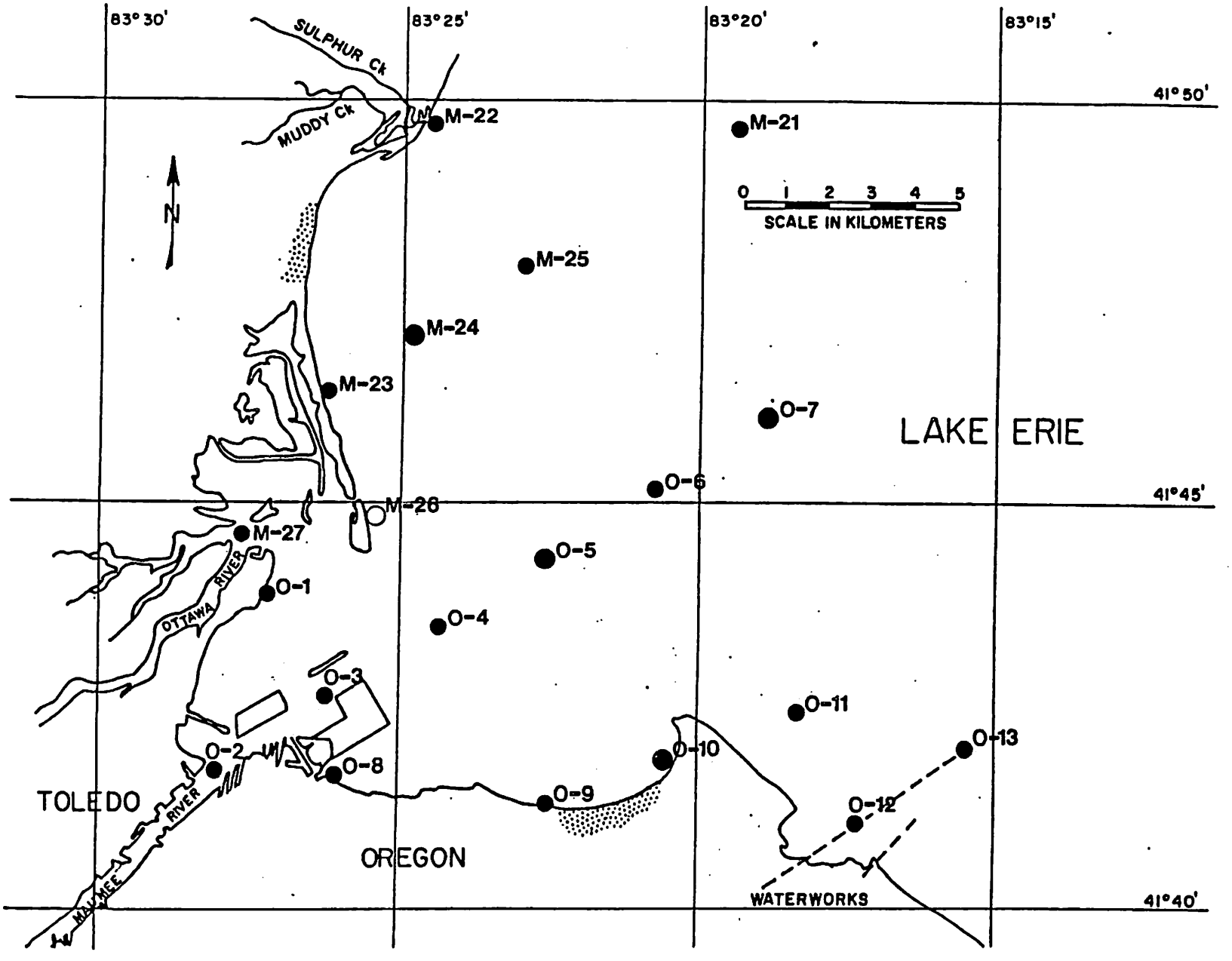

Figure 2. Nearshore Western Basin Station Map - Muddy Creek, Michigan to Toledo, Ohio's Water Intake.

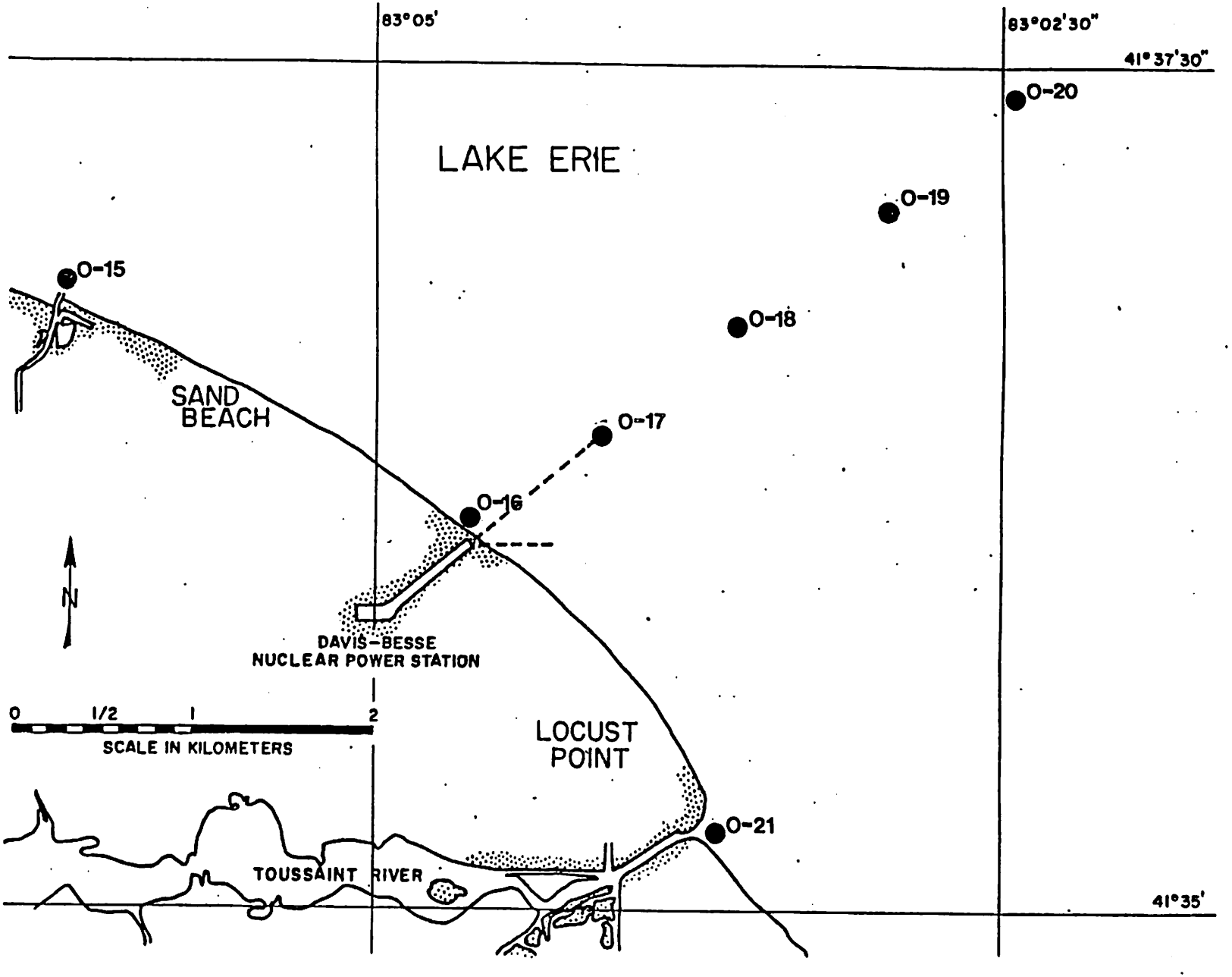

Figure 3. Nearshore Western Basin Station Map, Sand Beach to Locust Point, Ohio.

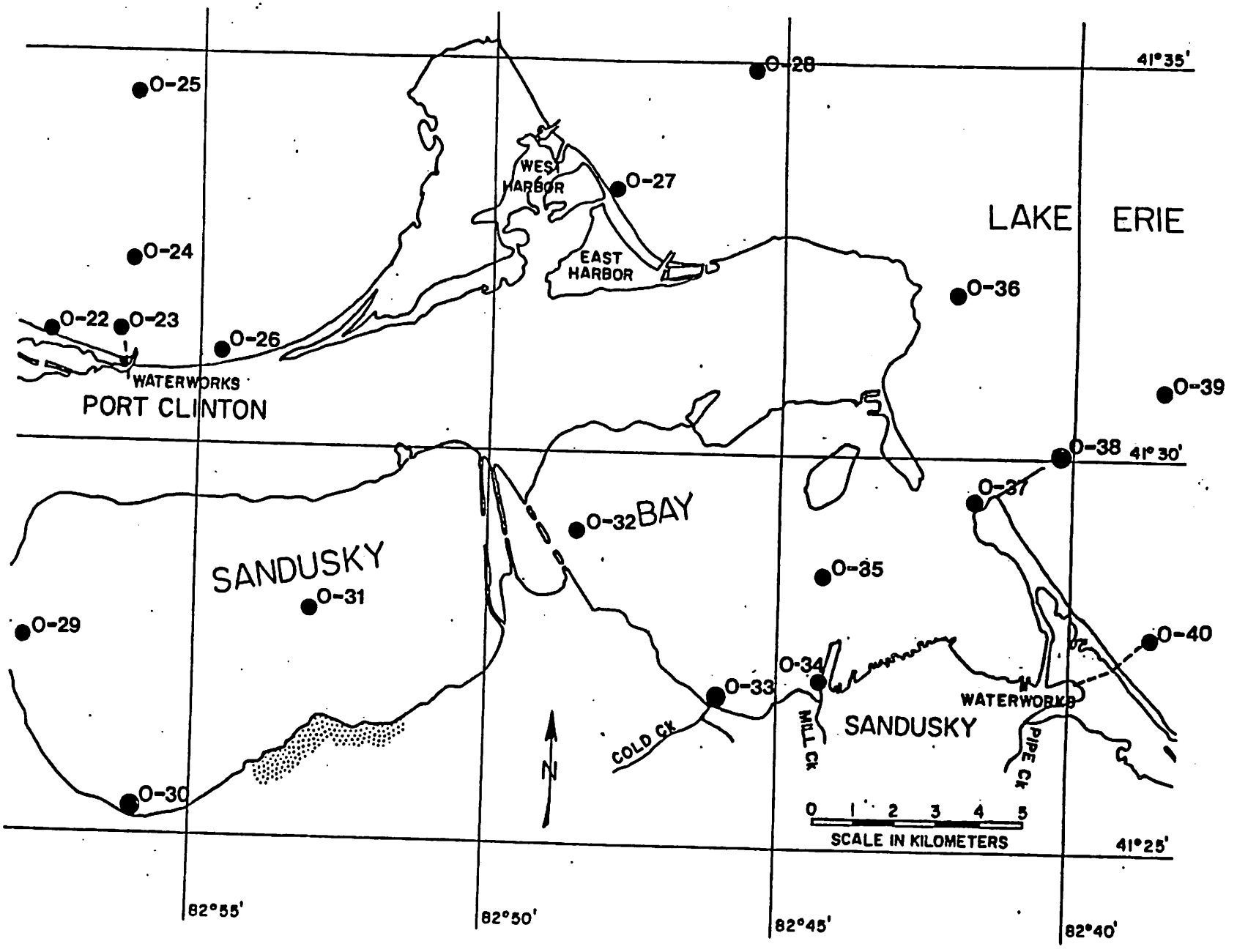

Figure 4. Nearshore Western Basin Station Map, Port Clinton, Ohio to Sandusky, Ohio including Sandusky Bay.

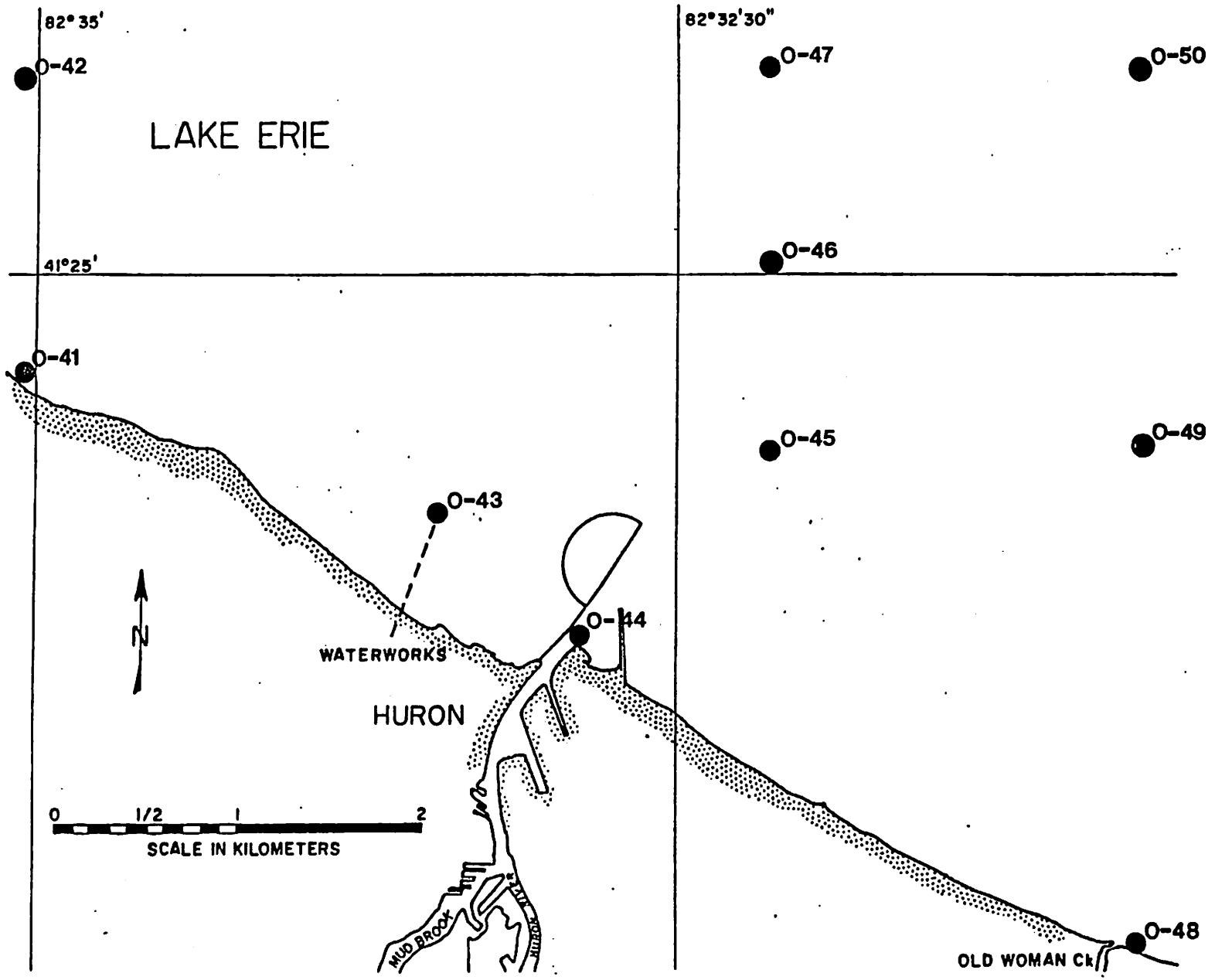

Figure 5. Nearshore Western Basin Station Map Sandusky, Ohio to Old Woman Creek, Ohio.

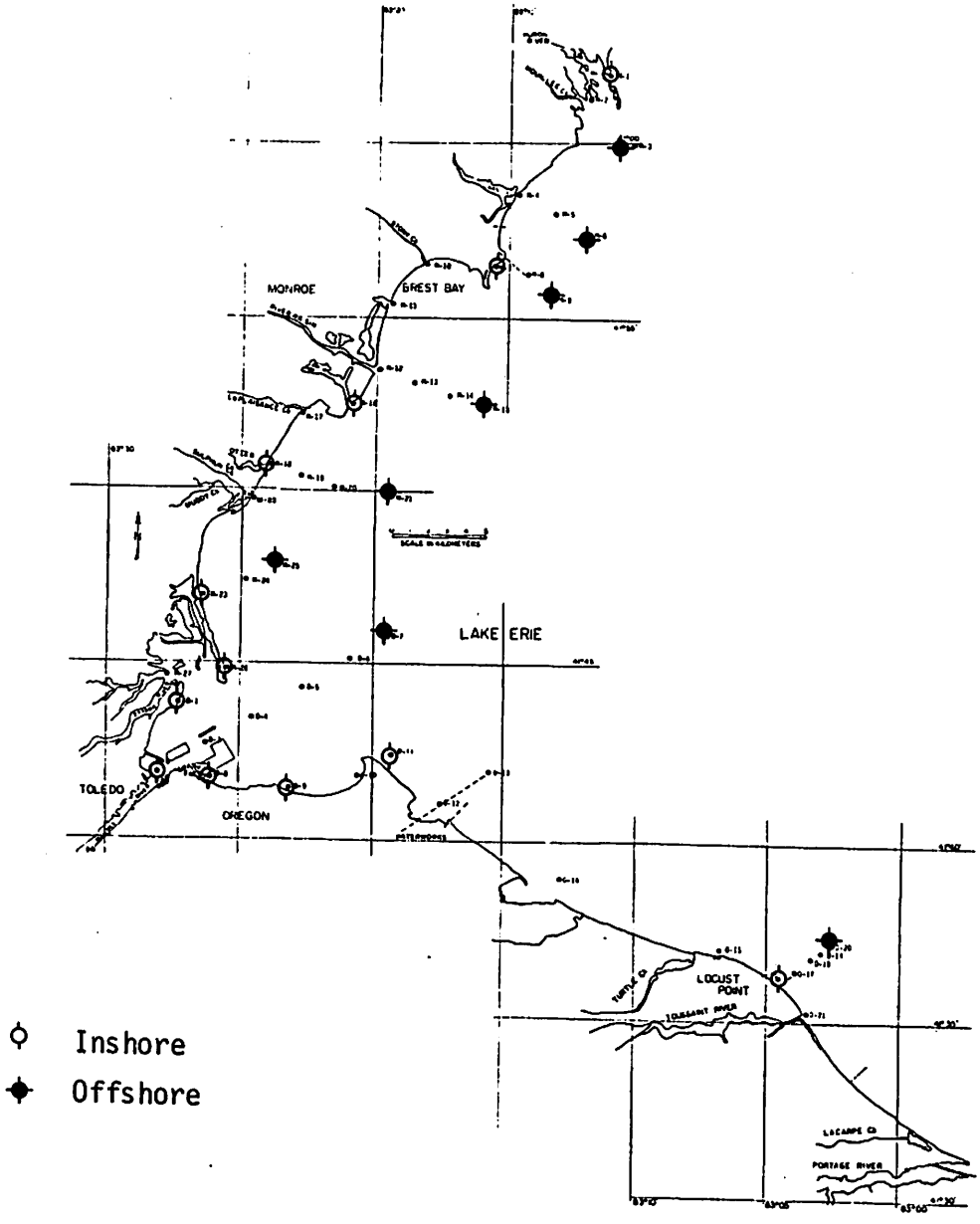

Figure 6. Western Basin Nearshore Map Showing Inshore-Offshore Couplets - Detroit, Michigan to Locust Point, Ohio.

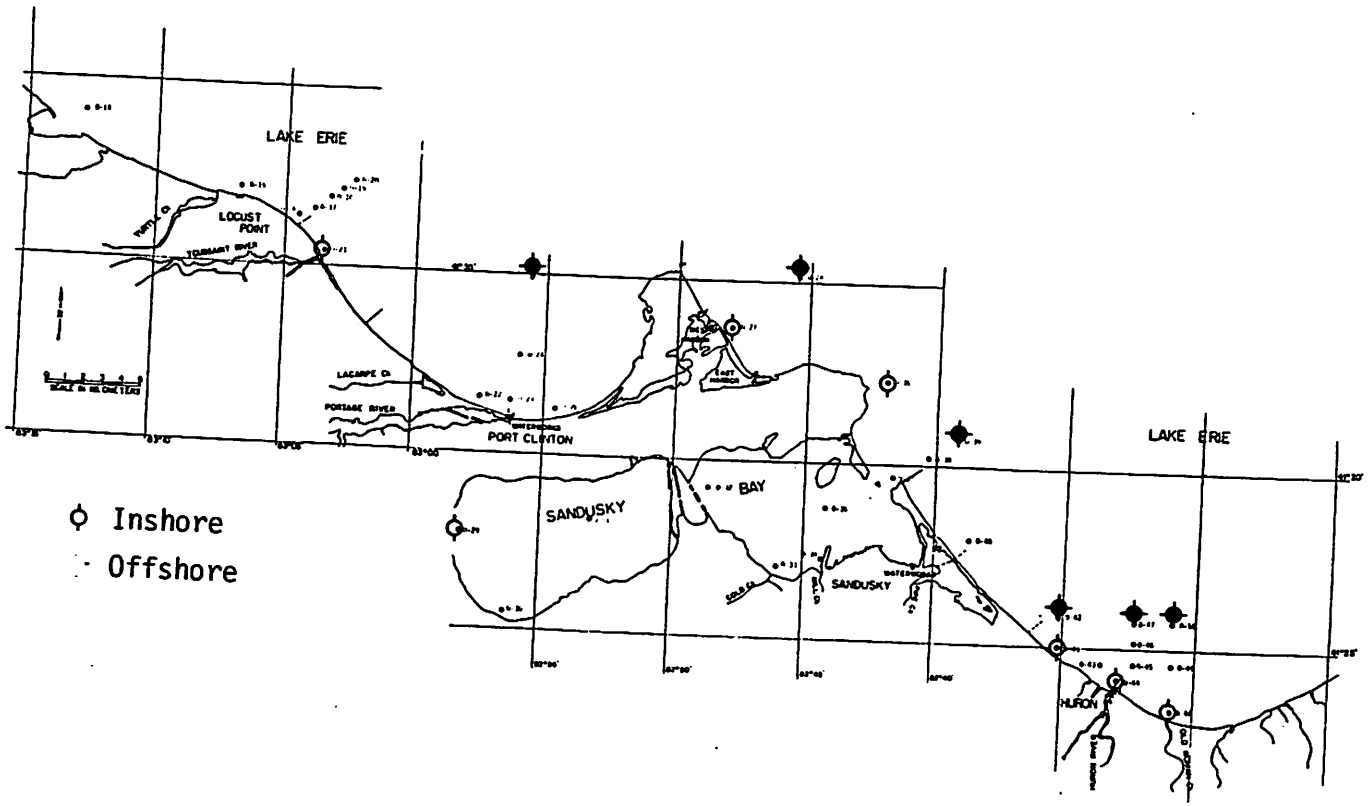

Figure 7. Western Basin Nearshore Map Showing Inshore-Offshore Couplets - Locust Point, Ohio to Huron, Ohio.