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SHEBOYGAN HARBOR, WISCONSIN

REPORT ON THE DEGREE OF POLLUTION OF BOTTOM SEDIMENTS

SAMPLED: OCTOBER 2, 1974

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V
GREAT LAKES SURVEILLANCE BRANCH

DISCUSSION OF RESULTS

Samples SHE-1, SHE-1A, and SHE-1B consist of silt and/or sand, and had low sludgeworm populations. Sediments at the other stations consisted of muck with a pudding-like consistency, and had high sludgeworm populations (Field Report).

The bulk sediment analysis data (Sediment Pollution Evaluation) indicate moderate organic and lead pollution at stations SHE-1B and SHE-2. Samples from the remaining stations indicate high organic and lead pollution and moderate to high zinc pollution. Moderate arsenic pollution and moderate to high chromium pollution is present at all the stations analyzed.

Considering the data collected, the pollutional classifications of the sediments are indicated on the attached map. Sediments from the area indicated as "Not polluted" are suitable for open lake disposal. Sediments from the areas designated "Moderately polluted" and "Heavily polluted" are unsuitable for open lake disposal.

The survey conducted 17 April 1969 found the eastern half of the area presently indicated as moderately polluted to be unpolluted, and the western half of this area to be heavily polluted. The classifications of the two surveys agree in other areas of the harbor.

Comparison of the two surveys indicates no substantial change in pollutional levels in the interim.

FIELD REPORT

Harbor : Sheboygan
State : Wisconsin
Sampled: October 2, 1974

Sample or Station No.	Location	Depth	Observations
SHE-1	43° 44' 55.2" 87° 41' 35.8"	8.0 meters	Light brown beach sand material. No odor, no detritus, and no organisms observed.
SHE-1A	43° 44' 55.6" 87° 41' 42.7"	9.0 meters	Brown material with pebbles, sand and silt. No odor. No detritus. Some organisms observed; sludgeworms.
SHE-1B	43° 44' 57.7" 87° 41' 42.7"	8.5 meters	Dark tan colored material. Mostly silt with some fine sand. No detritus. Mild musty odor detected. Some benthos observed; sludgeworms.
SHE-2	43° 44' 55.6" 87° 42' 00.8"	7.5 meters	Dark brown material. Mostly silt with some sand. Pudding-like consistency. Some detritus. No odor detected. Numerous sludgeworms observed. Oil present on sample.
SHE-3	43° 44' 56.5" 87° 42' 00.8"	7.5 meters	Dark brown material. Mostly silt with some sand (grit). Mucky pudding-like consistency. Some organic detritus. No odor detected. Numerous sludgeworms observed. Oil sheen on sample.
SHE-4	43° 44' 57.7" 87° 42' 00.8"	7.5 meters	Dark brown material. Mostly silt with mucky consistency. Some detritus. No odor detected. Numerous sludgeworms observed. Some oil on sample.
SHE-5	43° 44' 56.7" 87° 42' 09.0"	7.5 meters	Dark brown material. Silt with some fine sand (grit). Mucky consistency. Mild earthy odor. Organisms; fingernail clam, numerous sludgeworms
SHE-6	43° 44' 54.5" 87° 42' 32.5"	7.0 meters	Dark brown material. Silt with mucky pudding-like consistency. Very little detritus. Mild earthy odor. Many sludgeworms observed.
SHE-7	43° 44' 41.3" 87° 42' 40.2"	7.0 meters	Dark brown material. Silt with mucky pudding-like consistency. Some detritus. Mild organic odor. Numerous sludgeworms observed.

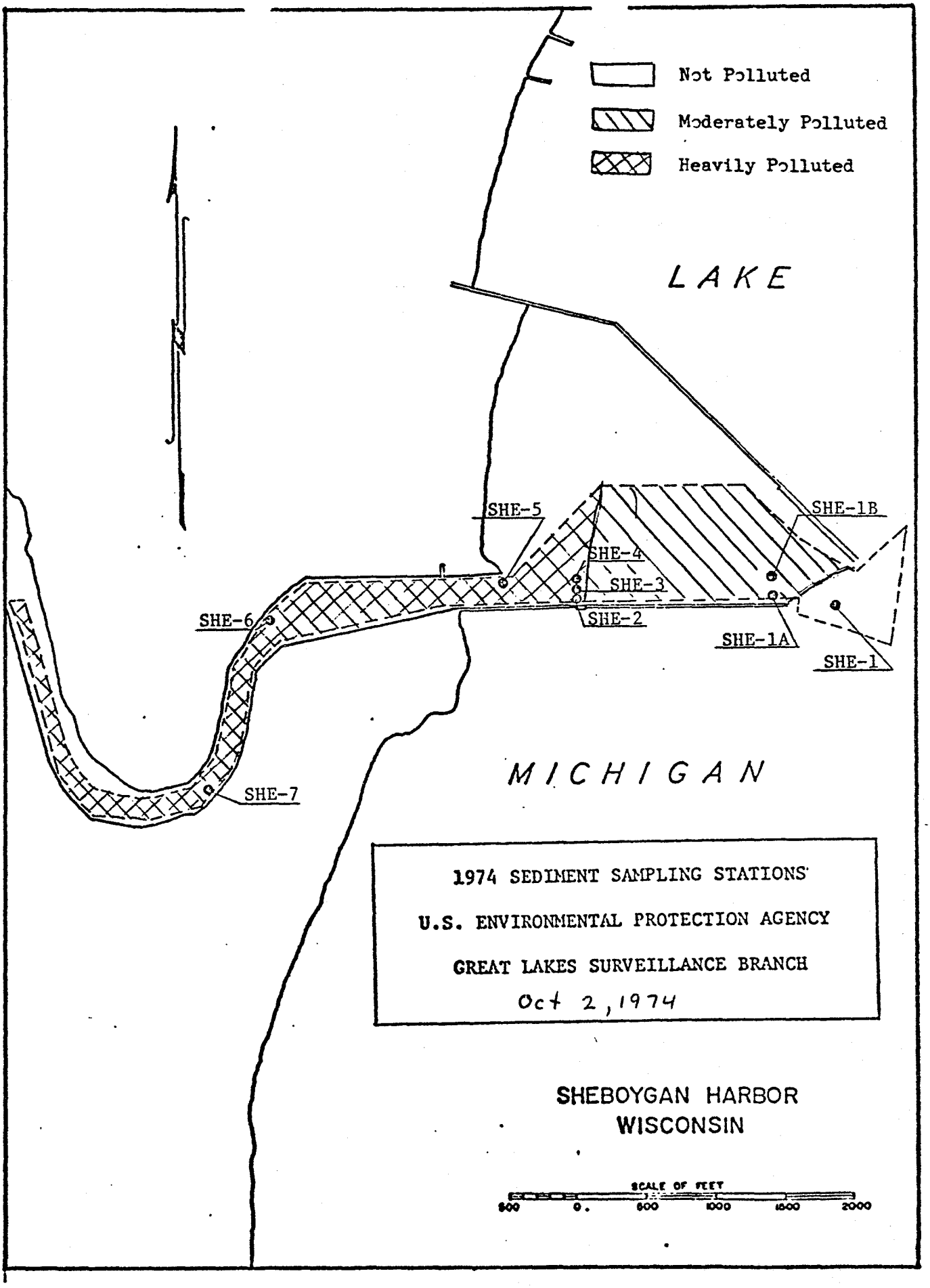
SEDIMENT POLLUTION EVALUATION

Harbor: Sheboygan

State: Wisconsin

Sampled: October 2, 1974

EVALUATION PARAMETERS	VALUE AT EACH STATION AS A PER CENT OF DRY WEIGHT					
	SHE-1B	SHE-2	SHE-4	SHE-5	SHE-6	SHE-7
Volatile Solids	6.49	5.04	8.90	10.43	12.34	11.99
Chem. Oxy. Demand	6.00	3.90	8.30	11.00	12.00	14.00
T. Kjel. Nitrogen	0.2300	0.1300	0.2900	0.4000	0.4500	0.4300
Oil-Grease	0.0500	0.0700	0.0950	0.0600	0.0900	0.2700
Mercury	<0.00002	<0.00002	<0.00002	<0.00002	<0.00003	0.00005
Lead	0.0050	0.0045	0.0115	0.0135	0.0145	0.0220
Zinc	0.0082	0.0068	0.0151	0.0170	0.0185	0.0265
Supplementary:						
Arsenic	0.00036	0.0002	0.00036	0.00048	0.00037	0.000
Cadmium	0.0003	0.00008	0.00026	0.00034	0.00035	0.00045
Chromium	0.0068	0.0044	0.0066	0.0100	0.0100	0.0350


Not Polluted
Moderately Polluted
Heavily Polluted
LAKE
SHE-5
SHE-1B
SHE-4
SHE-3
SHE-6
SHE-2
SHE-1A
SHE-1
MICHIGAN
SHE-7
1974 SEDIMENT SAMPLING STATIONS
U.S. ENVIRONMENTAL PROTECTION AGENCY
GREAT LAKES SURVEILLANCE BRANCH
Oct 2, 1974
SHEBOYGAN HARBOR
WISCONSIN
SCALE OF FEET
800 0. 800 1000 1600 2000

4.3.53

DEPARTMENT OF THE ARMY
CHICAGO DISTRICT, CORPS OF ENGINEERS
219 SOUTH DEARBORN STREET
CHICAGO, ILLINOIS 60604

REPLY TO
ATTENTION OF:
NCCED-H

7 MAR 1978

Regional Administrator
U.S. Environment Protection Agency
Mr. Merle W. Tellekson
230 South Dearborn Street
Chicago, Illinois 60604

Dear Mr. Tellekson:

Inclosed is the Water Quality Monitoring Program Design Analysis for the proposed Confined Disposal Facility at Sheboygan Harbor, Wisconsin. Your comments on the proposed monitoring program are requested in the interest of providing a well-coordinated monitoring effort.

If you have any questions concerning this matter please contact Mr. Norm Niedergang, Water Quality Coordinator, FTS-8-353-6472.

Sincerely yours,

Lawrence F. Coffill

1 Incl
as stated

LAWRENCE F. COFFILL
Chief, Engineering Division

SHEBOYGAN HARBOR, WISCONSIN

CONFINED DISPOSAL FACILITY

APPENDIX D
WATER QUALITY MONITORING

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APPENDIX D
WATER QUALITY MONITORING

PURPOSE

1. The purpose of this appendix is to identify the criteria used in the design of a water quality monitoring program to be undertaken at the confined disposal facility at Sheboygan, Wisconsin.

REFERENCES

2. References.

a. "Report on the Degree of Pollution of Bottom Sediments in Sheboygan," Federal Water Pollution Control Administration (FWPCA), August 1969.

b. "Report on the Degree of Pollution of Bottom Sediments," Sheboygan Harbor, United States Environmental Protection Agency (USEPA), 2 October 1974.

c. "Considerations on the Design of Water Quality Programs on Diked Disposal Areas in the Great Lakes," USEPA, 18 September 1975.

d. "Letter Report on Confined Disposal Area for Sheboygan Harbor, Wisconsin," Engineering Division, Chicago District, Corps of Engineers, revised July 1976.

BACKGROUND INFORMATION

3. The USEPA has sampled the bottom sediments at Sheboygan Harbor in April 1969 and again in October 1974. The pollutional classifications based on these two surveys are shown on Plates D-9 and D-13, respectively. Based on the 1974 sediment survey, the sediments westward of the entrance breakwater were classified as unsuitable for open-lake disposal. The results of both the 1969 and 1974 surveys are included on Plates D-3 to D-14.

OBJECTIVES OF MONITORING PROGRAM

4. Because of the polluted condition of the sediments to be placed in the disposal facility, a water quality monitoring program will be undertaken in order to detect any release of pollutants from the disposal area. If significant releases of pollutants are indicated by the monitoring program, the disposal operation would be discontinued until an acceptable method of confinement is found. The results of the monitoring program will be documented and evaluated with a view toward determining the most acceptable method of disposal and confinement. The data will also be used to determine the efficiency and pollutant removal capability of the filter cells.

WATER SAMPLING CRITERIA

5. Baseline background conditions. In order to determine if there is any deterioration of water quality as a result of the discharge from the disposal facility, and if there is any such deterioration to determine how severe it is and how far it extends, it is necessary to establish background water quality as well as water quality during and immediately after the discharge. The variability of most water quality data is such that it requires at least 25-30 samples to estimate the mean with a high degree of accuracy (ref. 2c).

6. Sampling Parameters. Certain parameters can be used to control the sampling program and to detect changes immediately. These parameters include temperature, specific conductivity, pH and turbidity. Suspended solids should be run to determine the efficiency of the sedimentation process in the disposal area. Ammonia should be run because it can be toxic, is a nutrient and is the compound most likely to be released from the dredged material in easily detectable quantities. Chlorides and sulfates should be run because they are soluble, conservative and can be used as tracers for a plume, if present (ref. 2c). Other parameters to be measured are based on the bulk sediment analyses of the polluted sediments. If bulk sediment concentrations of the material to be dredged exceed the following values, the parameter should be monitored, as explained in reference 2c:

Total Kjeldahl nitrogen (TKN)	2000 mg/kg	Manganese	500 mg/kg
Phosphorus	650 mg/kg	Arsenic	8 mg/kg
Lead	60 mg/kg	Cadmium	6 mg/kg
Zinc	200 mg/kg	Chromium	75 mg/kg
Cyanide	0.25 mg/kg	Barium	60 mg/kg
Iron	25,000 mg/kg	Copper	50 mg/kg
Nickel	50 mg/kg		

Certain parameters should be run either because they may be likely to be released into solution by the sediments or they may be a health hazard. Examples of these types of pollutants include manganese, fecal coliforms, arsenic and PCB's.

7. Biology. Macroinvertebrate samples should be collected from the receiving waters before the discharge starts and again near the end or immediately after the discharge ceases. This will enable any effects that the discharge may have had on the benthic community of the receiving waters to be detected and documented (ref. 2c).

MONITORING PLAN

8. Parameters to be monitored.

a. The USEPA has recommended that certain parameters be monitored at all dredged material disposal operations. The following parameters will be monitored based on these recommendations:

Temperature
Specific conductivity
pH
Turbidity
Ammonia
Chlorides
Sulfates
Suspended solids

b. Table D-1 lists the available sediment data for Sheboygan Harbor, compiled from Plates D-9 and D-13, for comparison with the USEPA criteria as discussed in paragraph 6. The following parameters will be analyzed based on the comparisons shown in Table D-1:

TKN
Total phosphorus
Lead
Zinc
Chromium
Copper

The following parameters will be measured because of possible effects on aquatic life and human health:

Dissolved oxygen (DO)
Fecal coliforms
PCB's
Arsenic

Manganese will be measured due to its susceptability to be released from sediments during dredging.

c. Based on the above selections, the water quality analysis will include the following parameters:

Temperature	TKN
Specific conductivity	Total phosphorus
pH	Lead
Turbidity	Zinc
Ammonia	Chromium
Chlorides	Copper
Sulfates	DO
Suspended solids	Fecal coliforms
PCB's	Arsenic
	Manganese

9. Water Sampling Frequency and Locations

a. A total of 25 water samples will be obtained to establish background conditions before the first disposal operation. The 25 samples will be taken from sampling locations 2 and 5, as shown on Plate D-2 and in Table D-2. Subsequent disposal operations will require a check on background conditions. Five samples will be obtained prior to each subsequent disposal project. These samples will be taken from sampling site 2. Improvement in municipal and industrial waste treatment may significantly improve the water quality in the Sheboygan area. A complete redetermination of background conditions may become necessary during late-stage filling operations. A periodic examination of data from existing water quality monitoring locations in the Sheboygan area will reveal any need for reestablishing background conditions.

b. Sampling during disposal operations will be accomplished at 5 locations as shown on Plate D-2 and in Table D-2. The samples will be collected at each of the sites on a biweekly basis for the first 2 weeks of disposal and on a weekly basis for the remainder of the disposal operation. The water samples will be composite vertical samples, a homogeneous mixture of water for the total depth, for sampling locations 1, 3, 4 and 5. Samples from site 2 should be collected from the surface, mid-depth and one foot above the bottom. Samples will be taken at the same time each day in order to avoid diurnal variations. Ten percent replicate analysis will be performed for analytical quality control.

c. Sampling at locations 4 and 5 will provide a means for detecting any diffusion of pollutants through the confinement wall. Sampling at locations 2 and 3 will assure detection of any release of pollutants from the confinement facility through the filter cells. During final filling operations, these locations will be used to determine the efficiency of the filter cells. Sampling location 3 will be used to determine the extent of any plume should one occur. If a detectable plume occurs, the sampling program will be modified to follow the main axis of the plume. Additional or revised sampling locations may also be required in this case.

10. Sediment Sampling

a. One sediment sample will be collected during each week of the dredging and disposal operation. The sample will be taken from the scows used to transport the dredged material to the disposal area. The area from which the sampled sediment was dredged, as well as the predicted area of placement within the disposal area, will be recorded. The results of this sampling will allow comparison with subsequent sediment analyses to help predict sediment quality trends and effluent quality out of the disposal area.

b. The sediment samples will be analyzed for the following parameters:

Volatile solids
Chemical oxygen demand
Total Kjeldahl nitrogen (TKN)
Oil and grease
Mercury
Lead
Cyanide
Total phosphorus
Pesticides
PCB's

11. Biologic Sampling. Two samples will be taken from sampling site 3 to determine the benthic population. These samples will be taken before and after the first disposal operation. Benthic samples will not be taken at subsequent disposal operations unless there are significant changes in the concentrations of the chemical parameters sampled. The samples will be taken with a Peterson-type dredge and will be examined for the types, number and weight per unit area of the benthic population. The benthic samples will be retained for later testing if required.

DISCUSSION

12. This monitoring program design will be used in the preparation of plans and specifications for dredging and/or disposal operations. The actual sampling locations and parameters measured may be revised as new information becomes available or as actual site conditions may require. The monitoring program will be coordinated with appropriate state and Federal agencies at the time of each disposal operation. This coordination may result in revised monitoring programs for subsequent disposal operations.

TABLE D-1

COMPARISON OF SHEBOYGAN HARBOR SEDIMENT DATA WITH USEPA CRITERIA

All units are mg/kg, dry weight

PARAMETER	SEDIMENT DATA[1]									USEPA[2] CRITERIA	FREQUENCY[3] OF EXCEEDANCE	MONITOR?[4]	
Sample Year	1969			1974									
Sample Location	SHEB 69-8	SHEB 69-12	SHEB 69-16	SHE 1B	SHE 2	SHE 4	SHE 5	SHE 6	SHE 7			YES	NO
1. TKN	0	0	0	2300	1000	2900	4000	4500	4300	2000	5/6	X	
2. Phosphorus	962	1058	1642	0	0	0	0	0	0	650	3/3	X	
3. Lead	80	260	335	50	45	115	125	145	220	60	7/9	X	
4. Zinc	110	275	420	82	68	151	170	185	265	200	3/9	X	
5. Cyanide	0	0	0	0	0	0	0	0	0	0.25	0		
6. Iron	9240	13330	14800	0	0	0	0	0	0	25000	0/3		X
7. Nickel	20	20	20	0	0	0	0	0	0	50	0/3		X
8. Manganese	0	0	0	0	0	0	0	0	0	500	0		
9. Arsenic	0	0	0	3.6	2.0	3.6	4.8	3.7	3.0	8	0/6		X
10. Cadmium	NF	NF	NF	3	0.8	2.6	3.4	3.5	4.5	6	0/9		X
11. Chromium	170	350	1400	68	44	66	100	100	350	75	6/9	X	
12. Barium	0	0	0	0	0	0	0	0	0	60	0		
13. Copper	45	105	175	0	0	0	0	0	0	50	2/3	X	

0 Parameter not measured
NF Not Found
X Indicates whether or not parameter will be monitored

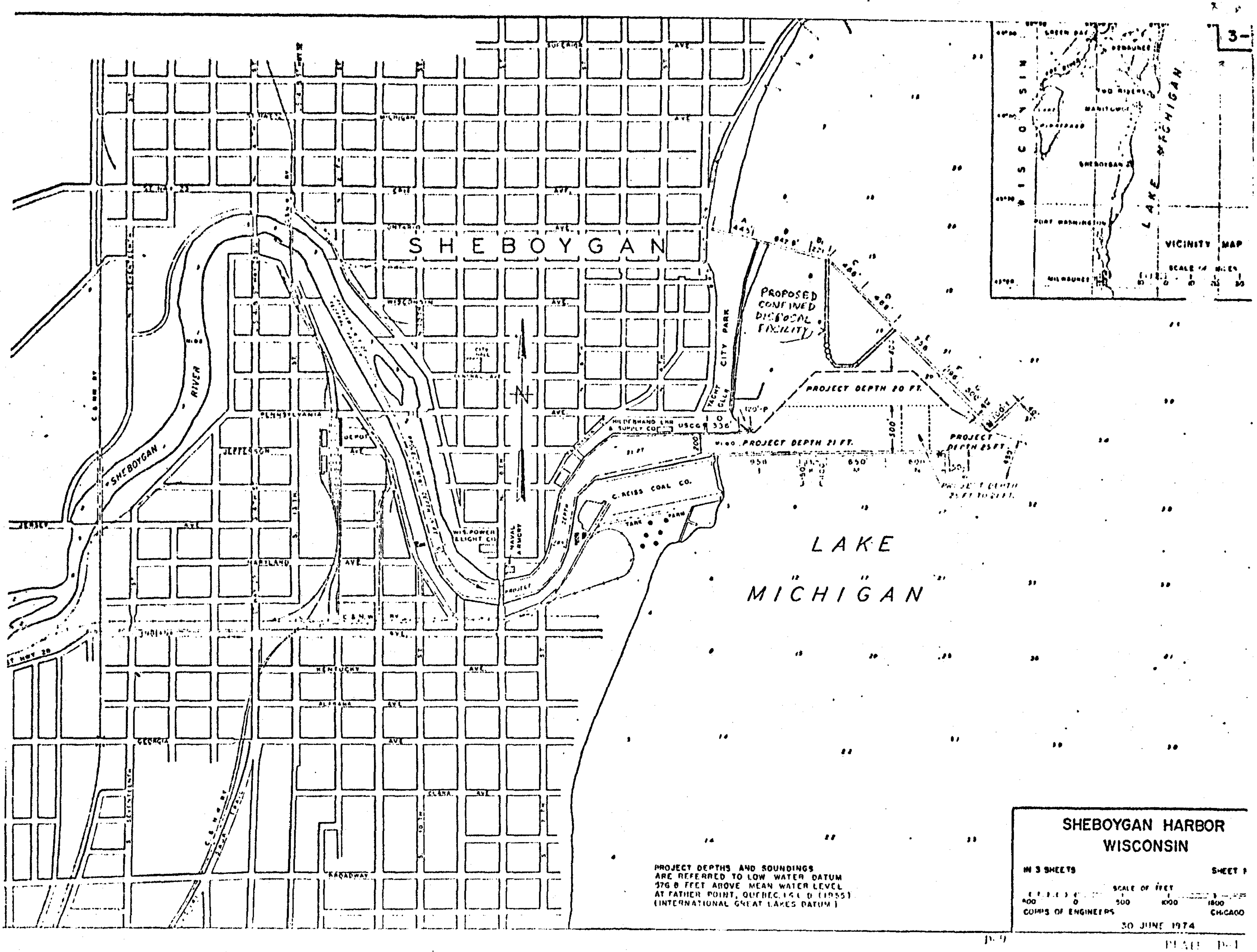
(1) Sediment data from references 2a and 2b.
(2) USEPA monitoring criteria from reference 2c.
(3) FREQUENCY OF EXCEEDANCE = # of times criteria is exceeded/# of times parameter is analyzed.
(4) If the criteria has been exceeded by any of the analyses, the parameter will be monitored.

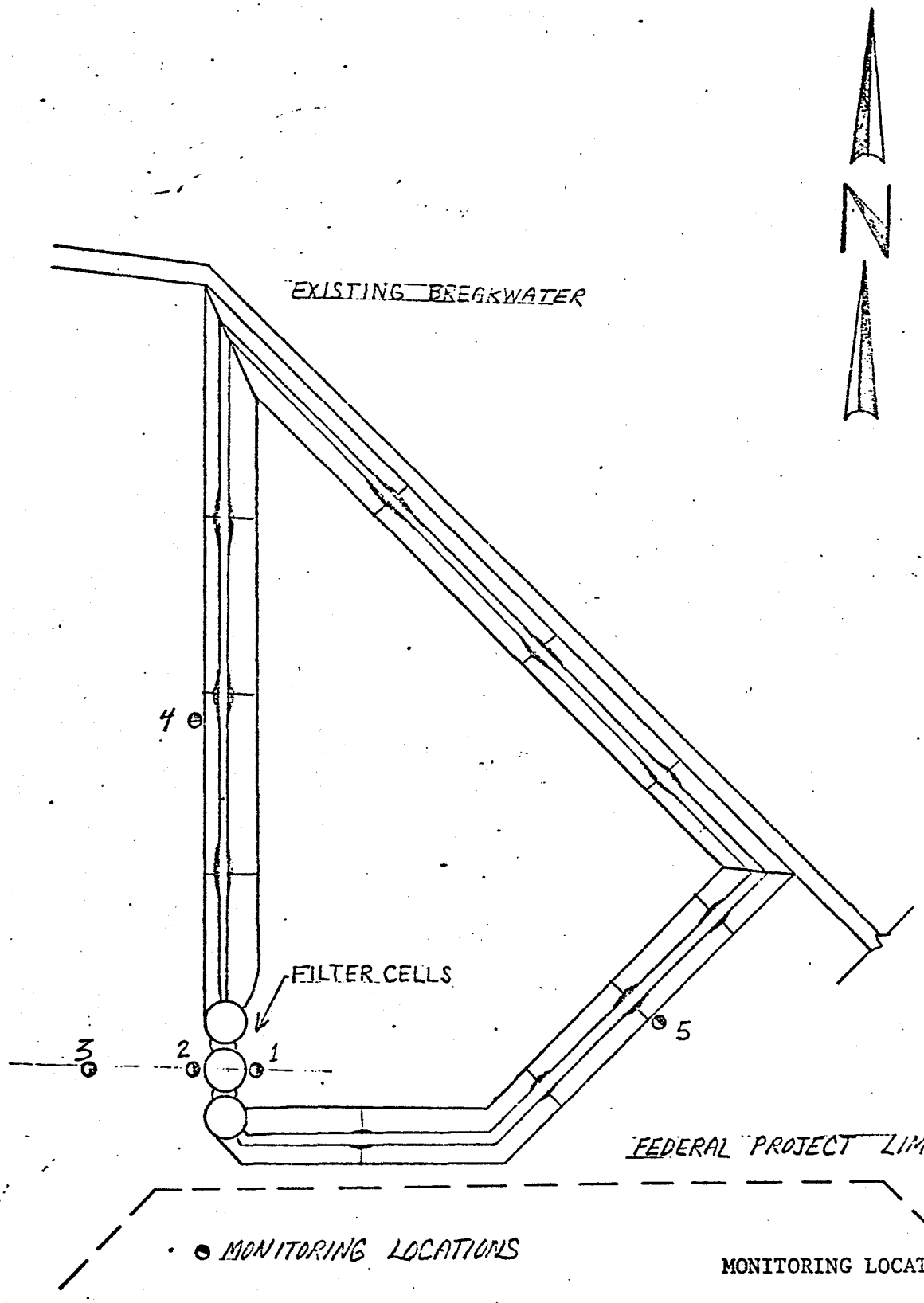
TABLE D-2

LOCATION OF SAMPLING POINTS
(SEE PLATE D-1)

Sampling Point	Location*
1	Inside disposal area adjacent to filter cells
2	Outside disposal area adjacent to filter cells
3	150 feet lakeward of filter cells on a line perpendicular to the eastern confinement wall
4	Adjacent to and outside of disposal area at mid-point of eastern confinement wall
5	Adjacent to and outside of disposal area at mid-point of southeastern confinement wall

*All sampling locations must be far enough from the containment structure to allow clearance of sampling equipment over the toe of the structure.


SHEBOYGAN
LAKE MICHIGAN
SHEBOYGAN RIVER
SUPERIOR AVE.
MICHIGAN AVE.
ERIE AVE.
ONTARIO AVE.
WISCONSIN AVE.
PENNSYLVANIA AVE.
JEFFERSON AVE.
JERSEY AVE.
MARYLAND AVE.
KENTUCKY AVE.
ALABAMA AVE.
GEORGIA AVE.
CITY HALL
CITY PARK
DEPOT
USCG
C. REISS COAL CO.
TANK FARM
WIS. POWER & LIGHT CO.
NAVAL ARMORY
PROPOSED CONFINED DISPOSAL FACILITY
PROJECT DEPTH 20 FT.
PROJECT DEPTH 21 FT.
PROJECT DEPTH 25 FT.
VICINITY MAP
WISCONSIN
GREEN BAY
MANITOWOC
SHEBOYGAN
PORT WASHINGTON
MILWAUKEE
PROJECT DEPTHS AND SOUNDINGS ARE REFERRED TO LOW WATER DATUM 576.8 FEET ABOVE MEAN WATER LEVEL AT FATHER POINT, QUEBEC, I.G.L.D. (1955) (INTERNATIONAL GREAT LAKES DATUM)
SHEBOYGAN HARBOR
WISCONSIN
IN 3 SHEETS
SHEET 1
SCALE OF FEET
CORPS OF ENGINEERS
CHICAGO
30 JUNE 1974



MONITORING LOCATIONS

SHEBOYGAN HARBOR, WISCONSIN

CONFINED DISPOSAL FACILITY

SCALE 1" = 20'

PLATE D-2