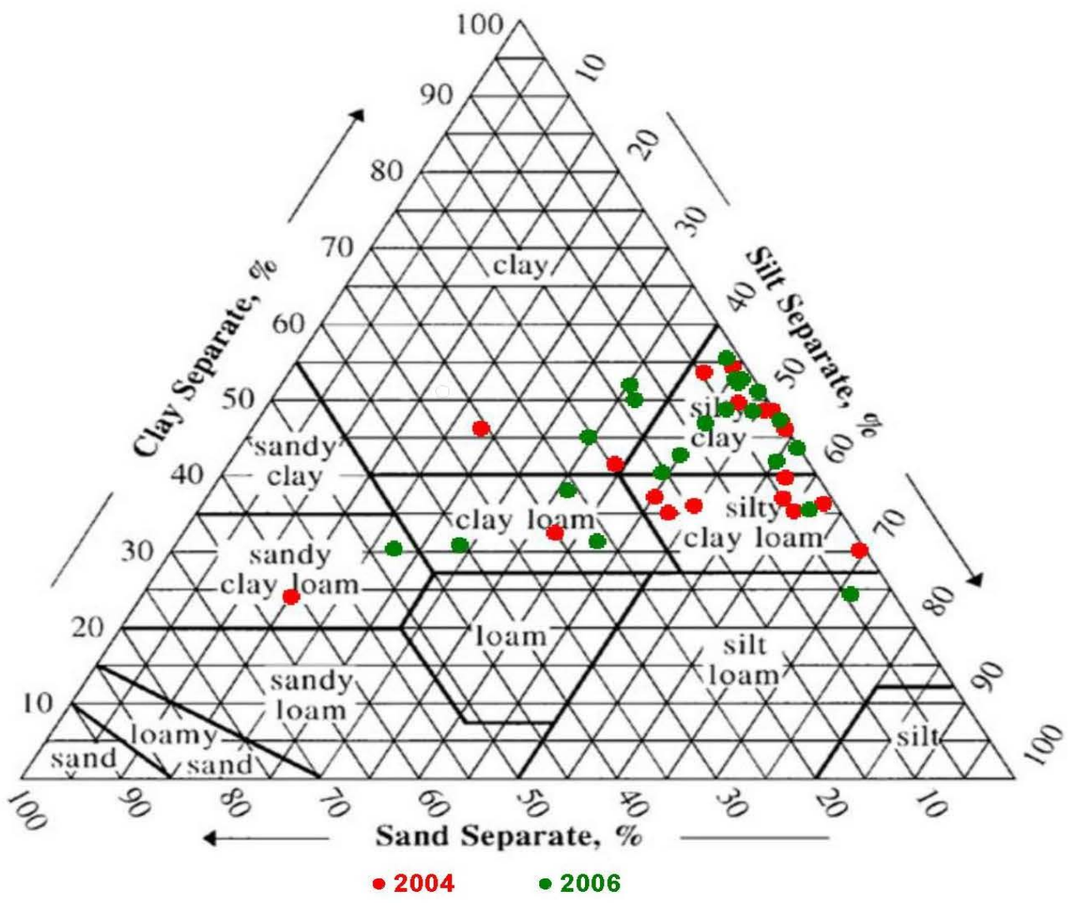
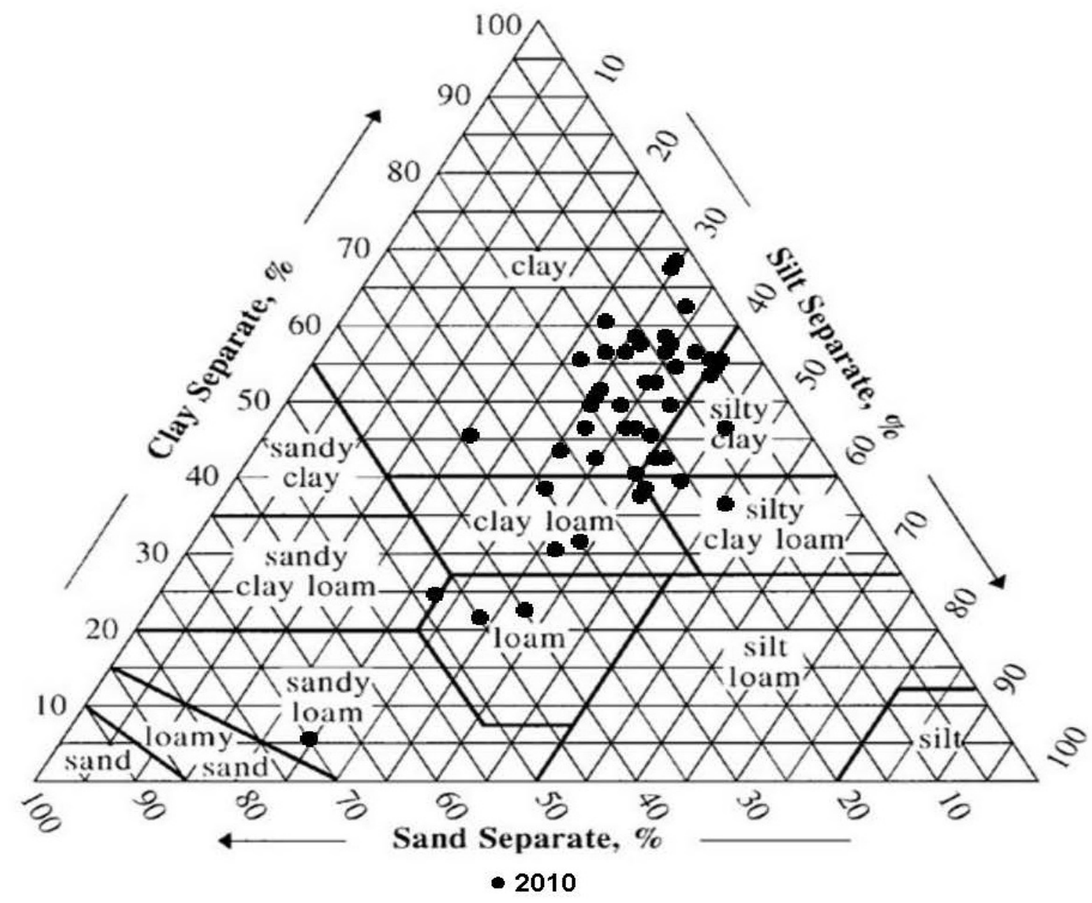
Particle Size Distribution of River and Harbor Channel Sediments, Toledo Harbor, Ohio

	Maumee River Channel									Toledo Harbor Channel																								
USACE 2010	RM-7.0	RM-6.0	RM-5.0	RM-4.0	RM-3.0	RM-2.0	RM-1.0	RM-0.5	RM-0.25	LM-0	LM-0.25	LM-0.5	LM-0.75	LM-1.0	LM-1.25	LM-1.5	LM-1.75	LM-2.0	LM-2.25	LM-2.5	LM-2.75	LM-3.0	LM-3.25	LM-3.5	LM-4	LM-5	LM-6	LM-7	LM-8.0	LM-9.0	LM-10.0	LM-11.0	LM-12.0	LM-13.0
Clay (%)	22	21	51	45	49	30	5	55	46									60	68	68	57	62	31	42					52	45	55	50	57	56
Silt (%)	37	33	30	20	33	36	24	40	35									26	29	29	31	33	38	41					35	38	39	30	34	28
Fine Sand (%)	31	8	2	9	11	11	24	0	1									4	2	2	1	1	18	8					7	3	1	1	2	7
Meduim Sand (%)	3	9	2	8	4	7	22	2	0									5	0	0	1	2	9	2					2	2	2	2	2	4
Coarse Sand (%)	7	21	9	6	3	5	13	3	18									5	1	1	10	2	4	7					4	12	3	17	5	5
Gravel (%)	0	8	6	12	0	11	12	0	0									0	0	0	0	0	0	0					0	0	0	0	0	0
EEI 2006																																		
Clay (%)	38	40	48	50	30	46	51			43	52	55	41	52	47	51	42	48																
Silt (%)	35	44	49	36	22	45	35			56	46	43	55	45	52	48	44	46																
Sand (%)	27	16	3	14	49	9	14			1	2	2	4	3	1	1	13	6																
EEI 2004																																		
Clay (%)										54				53				41				46			47	48	49	46	36	37	32			
Silt (%)										44				41				38				53			53	51	47	23	62	45	37			
Sand (%)										2				6				21				1			1	1	4	32	2	19	31			





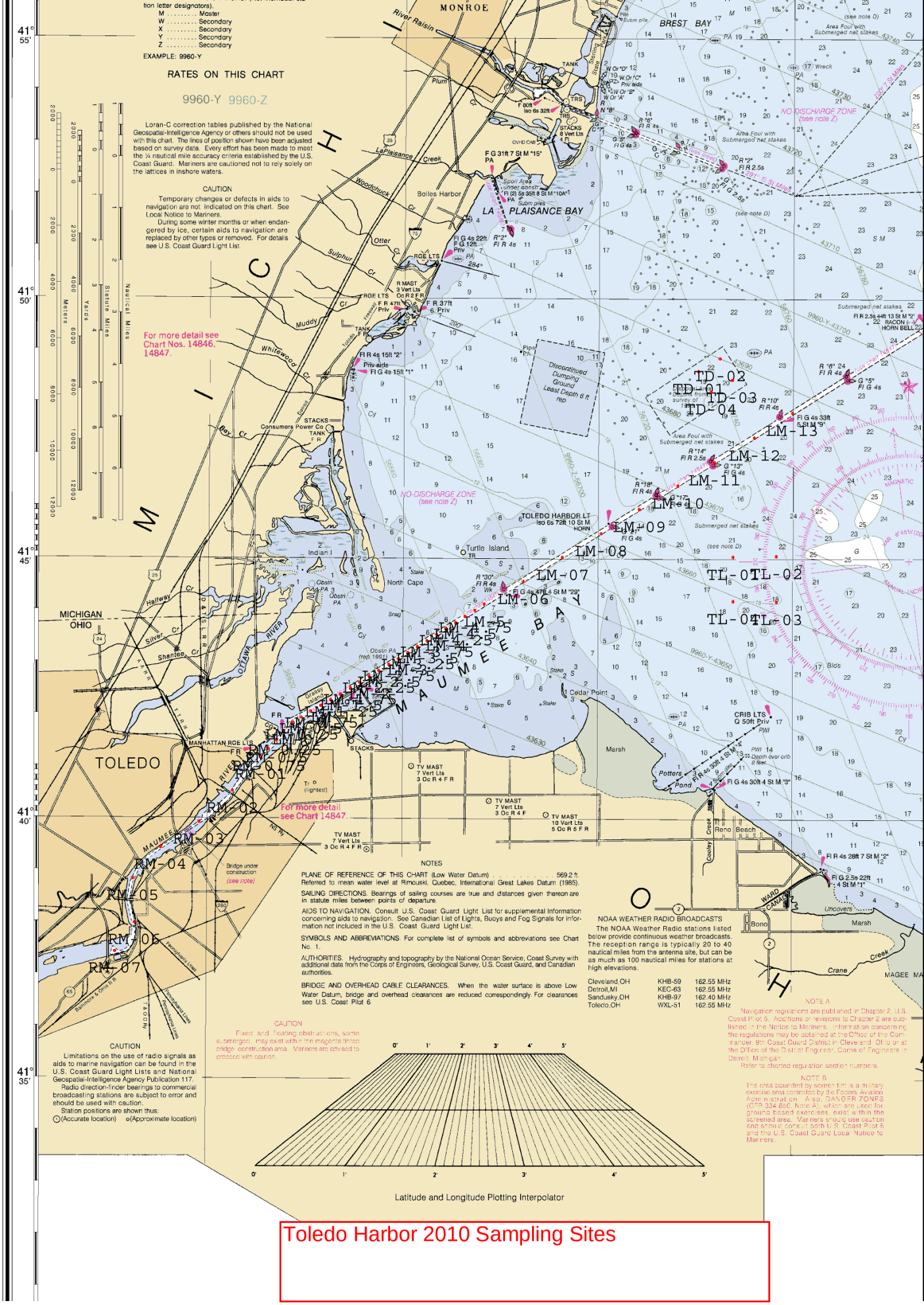


Chart Name:	WEST END OF LAKE ERIE
Chart ID:	14830_1
Top Left:	41° 55' 39" N 83° 39' 17" W
Bottom Right:	41° 30' 46" N 83° 11' 34" W

® MAPTECH, INC.

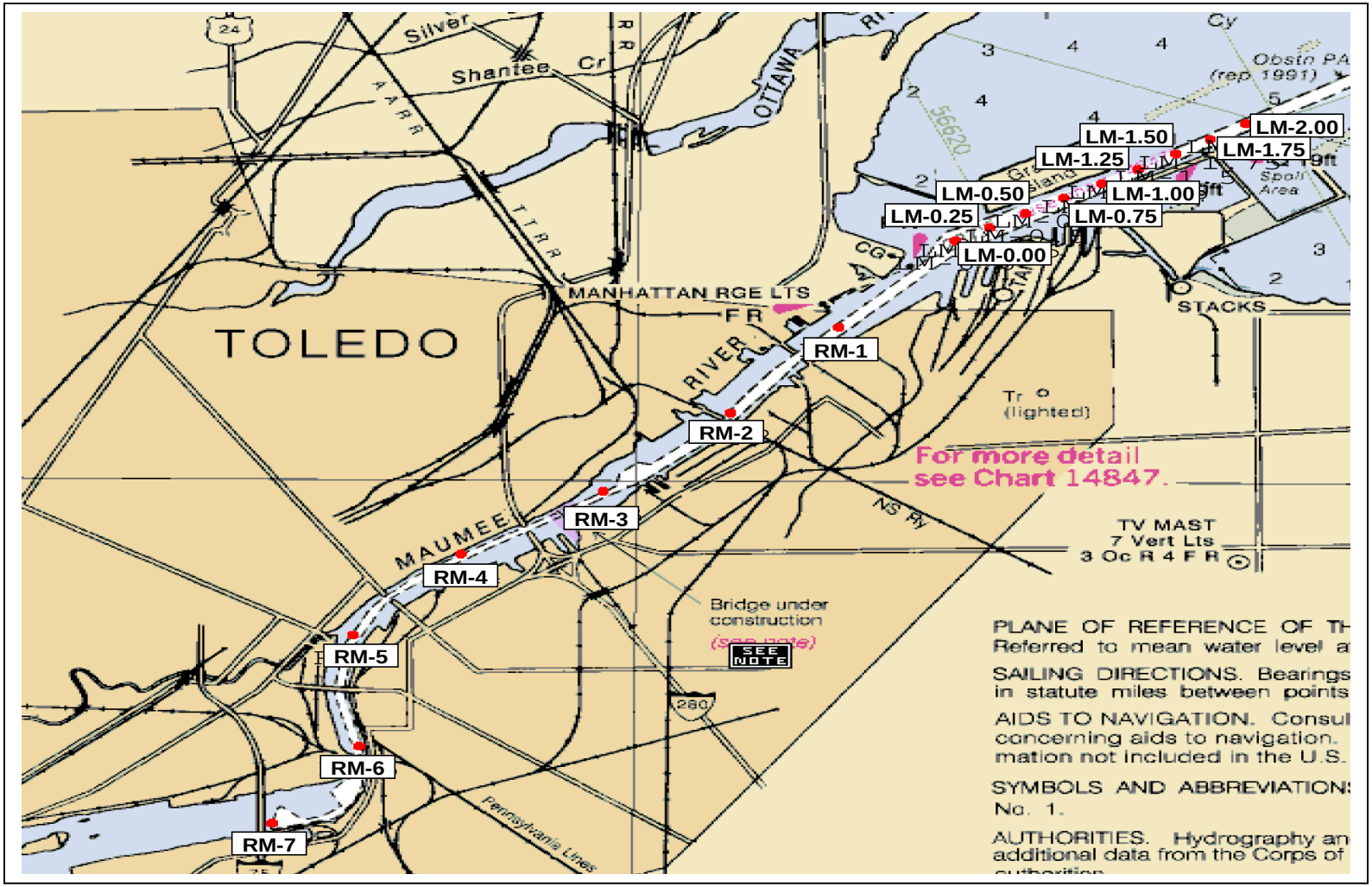


FIGURE 2. Toledo Harbor sediment 2006 sampling sites in Maumee River Channel and Upper Lake Approach Channel.

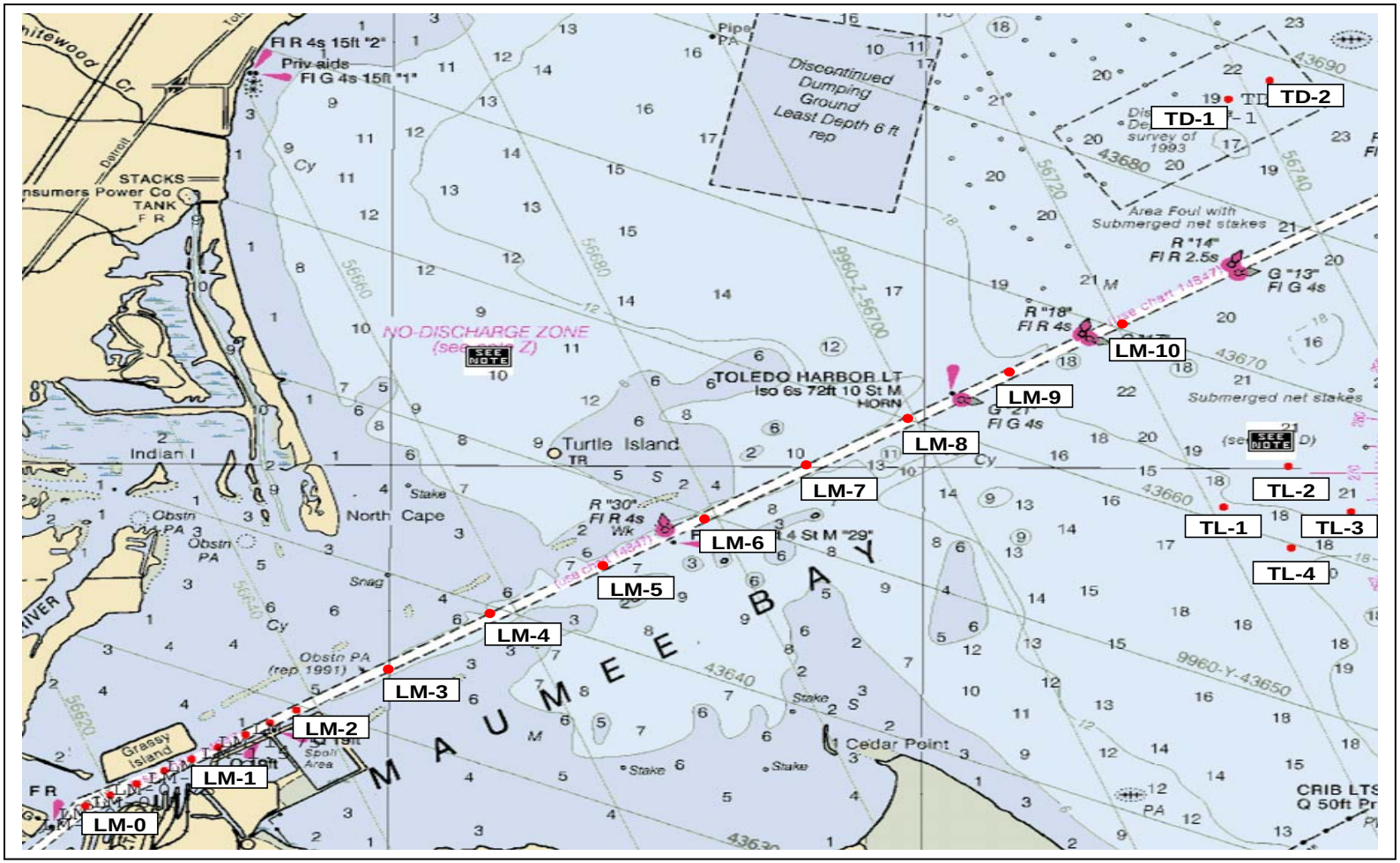
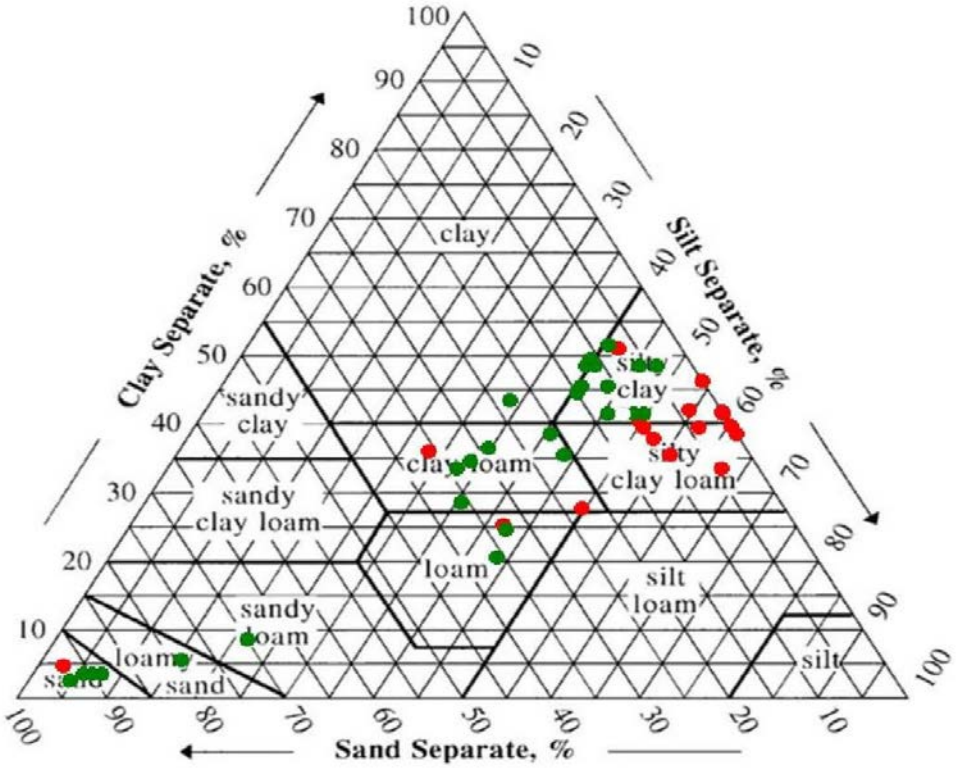


FIGURE 1. Toledo Harbor 2004 sediment sampling sites in Lake Approach Channel, and open-lake reference and placement areas.

Particle Size Distribution of Federal Navigation Channel and Lake Erie Vicinity Sediments, Sandusky Harbor, Ohio

	Dock Channel			Bay Channel (including Turning Basin)					Straight Channel				Moseley Channel						
TTL and RTI 2011	SH-1	SH-2	SH-3	SH-4	SH-5	SH-6	SH-7	SH-8	SH-9	SPS-1	SH-10	SPS-2	SH-11	SPS-3	SH-12	SPS-4	SH-13	SPS-5	SH-14
Clay (%)	48	48	45	48	41	28	36	45	24	20	3	2	8	5	38	35	34	43	33
Silt (%)	40	40	40	39	45	35	34	43	42	43	7	4	21	15	40	43	33	33	32
Fine Sand (%)	8	4	7	5	7	6	5	9	32	30	85	37	64	77	17	18	27	21	32
Meduim Sand (%)	4	8	8	8	7	10	2	3	2	7	5	37	7	3	5	4	6	3	3
Coarse Sand (%)	0	0	0	0	0	21	23	0	0	0	0	10	0	0	0	0	0	0	0
Gravel (%)	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0
Total Fines (Silt and Clay) (%)	12	12	15	13	14	37	30	12	34	37	90	94	71	80	22	22	33	24	35
Total Sand and Gravel (%)	88	88	85	87	86	63	70	88	66	63	10	6	29	20	78	78	67	76	65
EEI 2005																			
Clay (%)	41.0	45.8	41.3	35.5	50.5	39.2	41.5	39.0	27.2		24.7		4.2						
Silt (%)	59.0	53.8	58.1	27.6	41.4	60.5	53.9	56.2	49.0		41.4		2.1						
Sand (%)	0	0.4	0.6	36.9	8.1	0.3	4.6	4.8	23.8		33.9		93.7						
Gravel (%)	0	0	0	0	0	0	0	0	0		0		0						



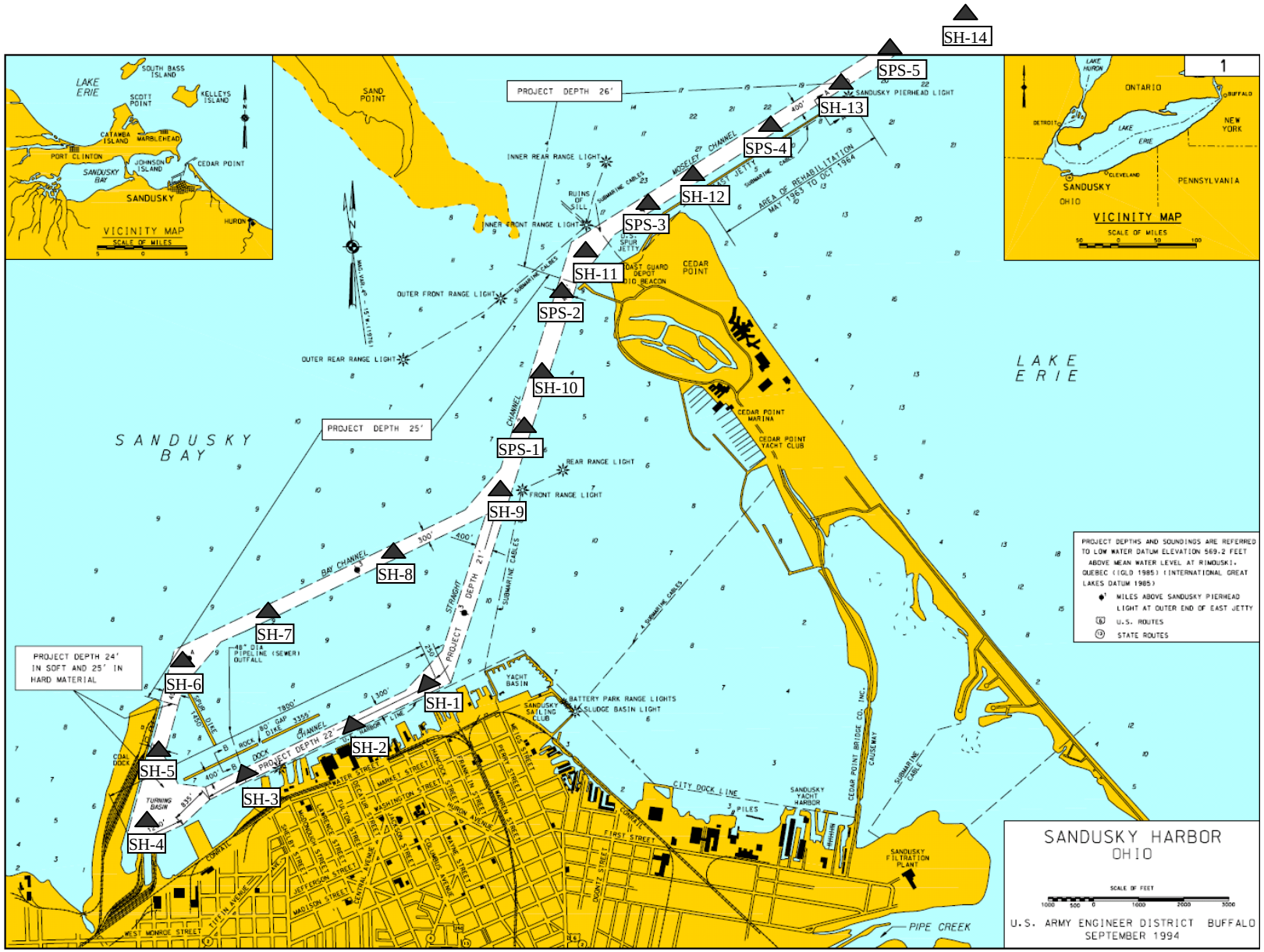


Figure 3 – 2011 Sandusky Harbor Sampling Sites.

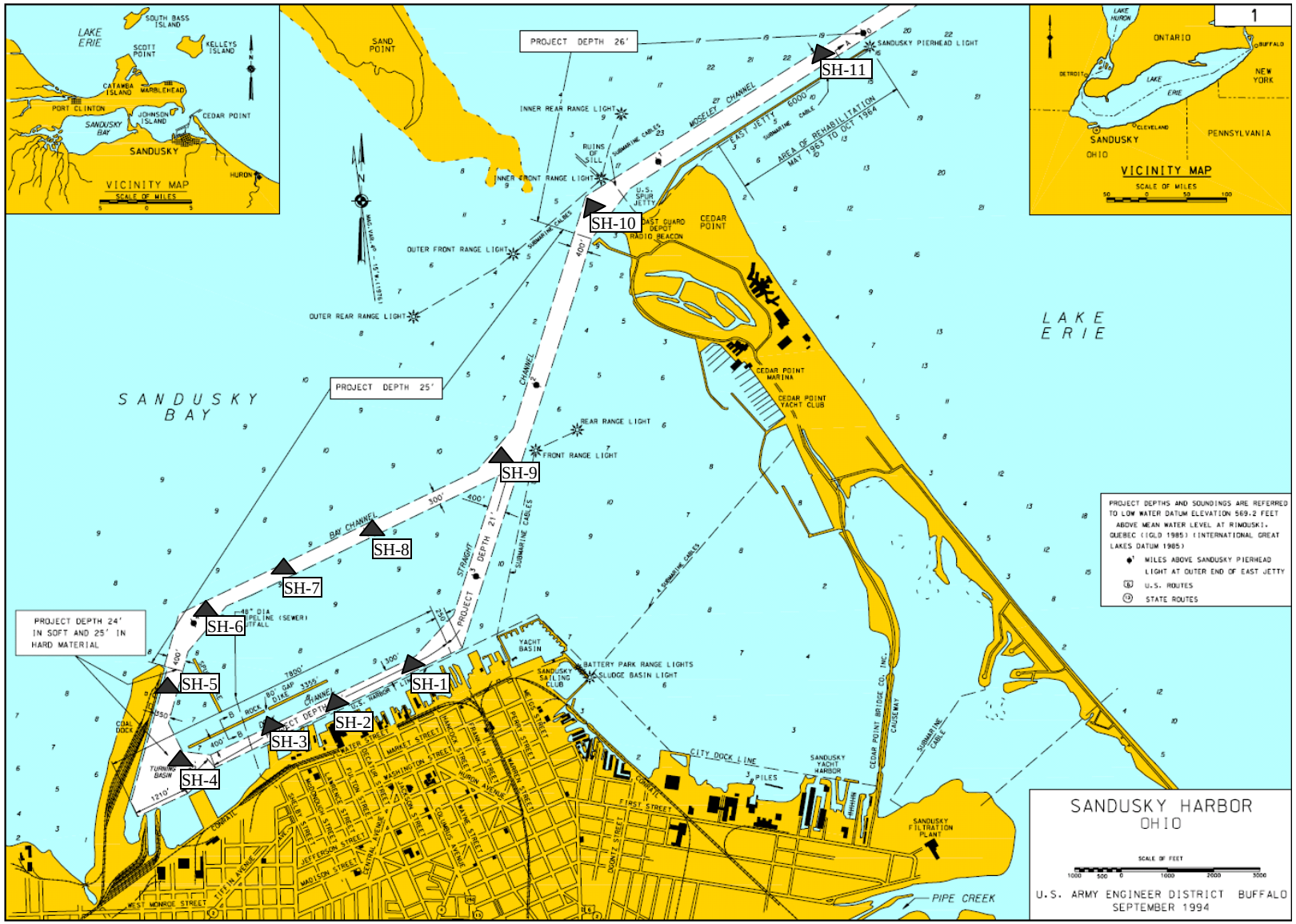
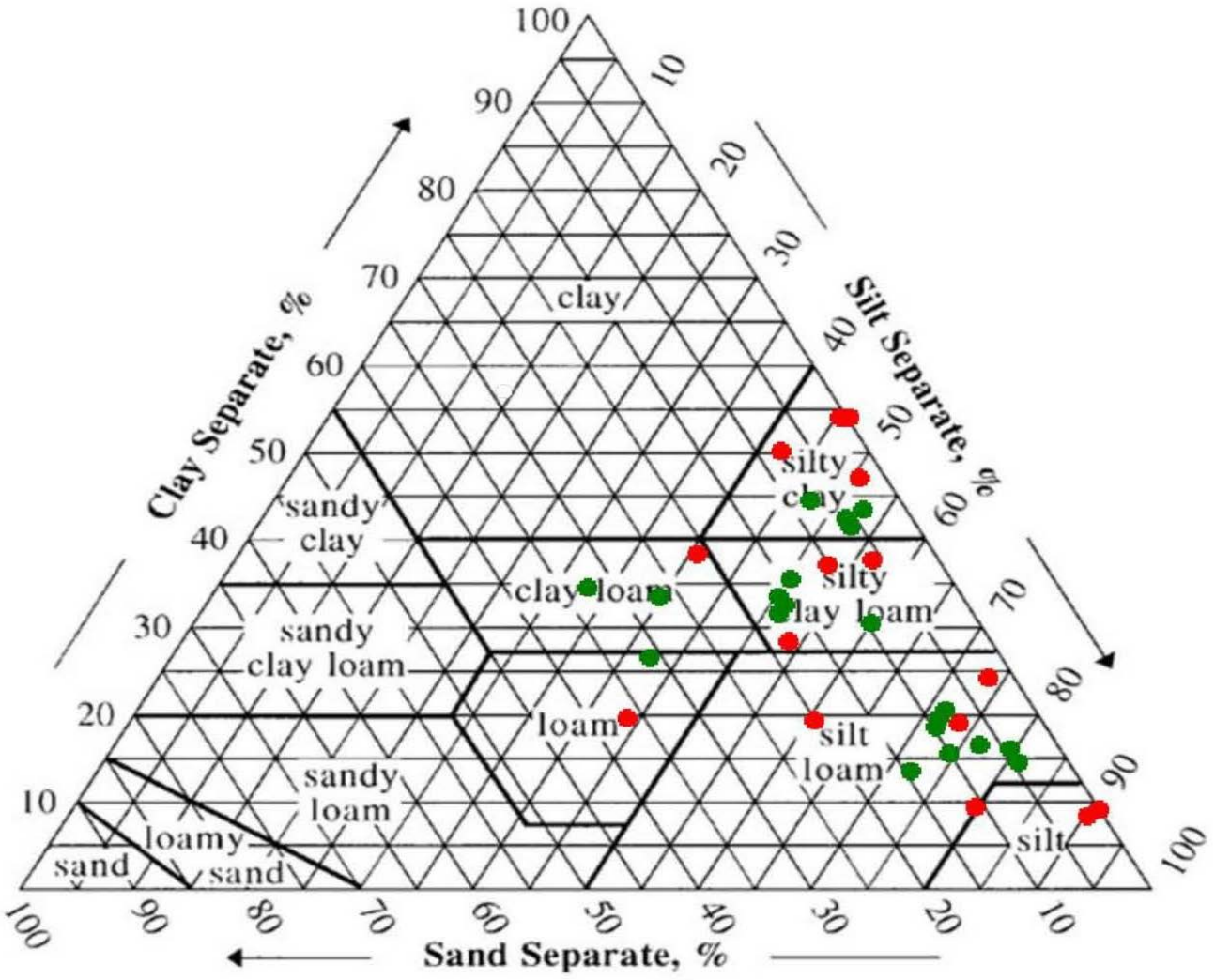
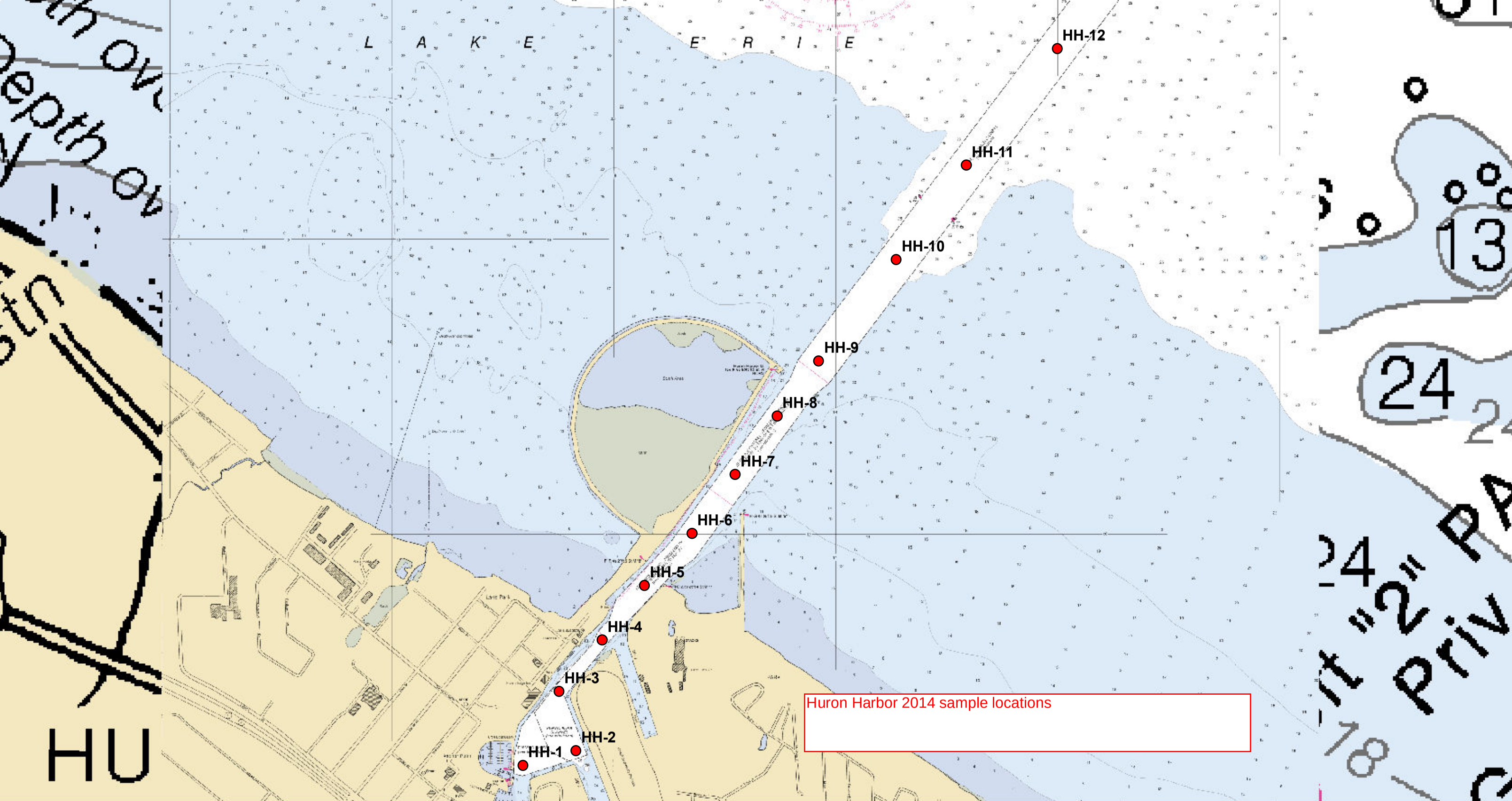


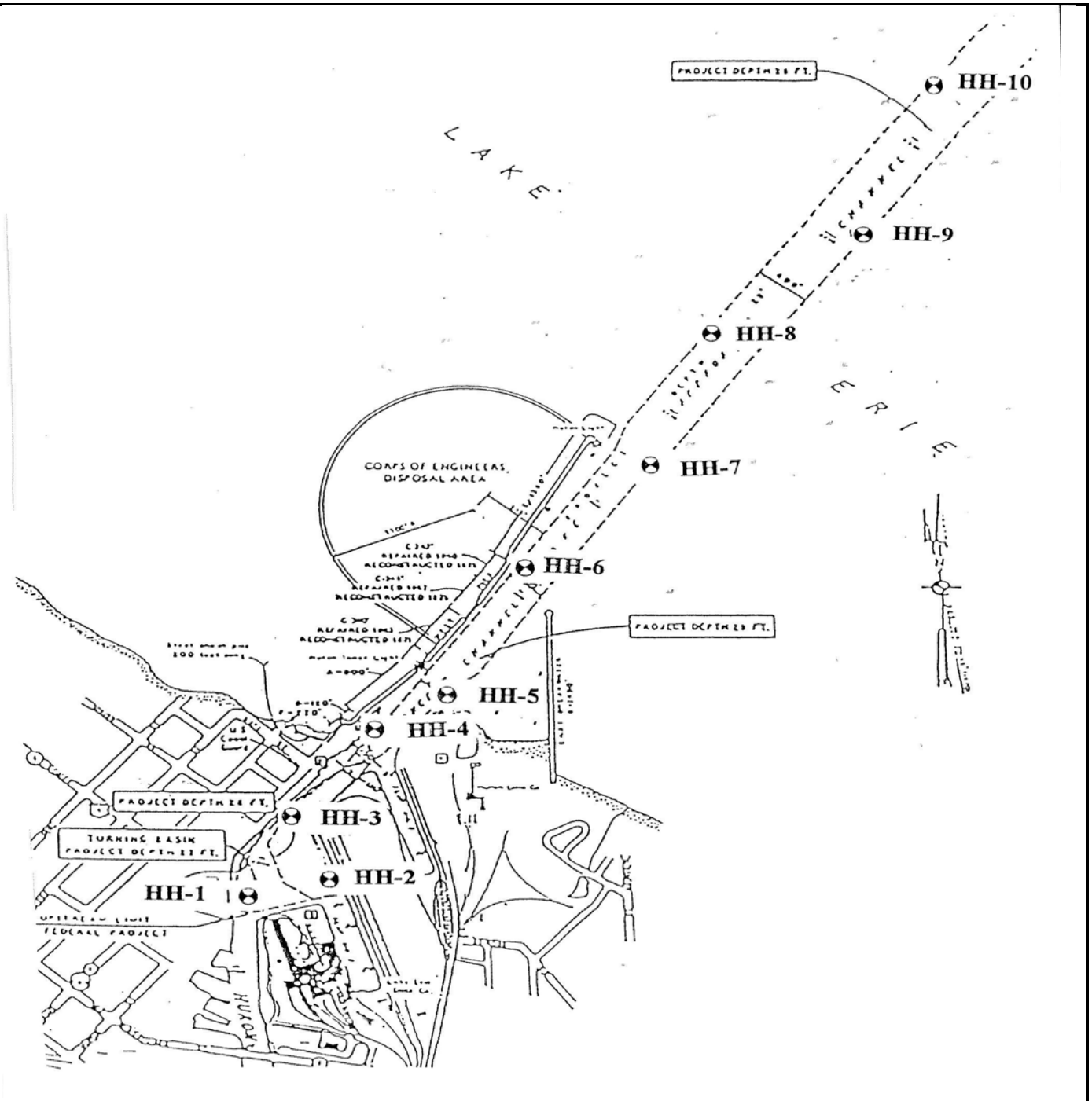
Figure 1 – 2005 Sandusky Harbor Sampling Sites.

Particle Size Distribution of Harbor Sediments, Huron Harbor, Ohio

	Harbor Area Sites											
RTI 2014	**HH-1**	**HH-2**	**HH-3**	**HH-4**	**HH-5**	**HH-6**	**HH-7**	**HH-8**	**HH-9**	**HH-10**	**HH-11**	**HH-12**
Clay (%)	34	41	33	35	43	44	42	30	15	13	14	15
Silt (%)	32	52	40	50	51	48	51	59	74	72	81	80
Fine Sand (%)	21	2	14	1.2	3.6	5.7	4.2	6	7.9	6	1.2	1.9
Medium Sand (%)	9.1	0.3	5.3	0.4	0.3	0.4	0.5	0.8	1	0.5	0.2	0.9
Coarse Sand (%)	2.5	4.6	8.3	13	1.9	2.9	2	3.7	2.2	8.8	4	2.6
Fine Gravel (%)	1.1	0.1 U	0.3	0.6	0.1 U	0.1 U	0.1	0.1	0.1 U	0.2	0.1	0.1
Coarse Gravel (%)	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
EEI 2005												
Clay (%)	18.5	19.1	53.5	53.5	53.5	46.6	8.9	7.8	8.6	23.7		
Silt (%)	73	43.3	44.9	45.7	45.6	50.1	79.3	89.8	90.4	73		
Gravel & Sand (%)	8.5	37.6	1.6	0.8	0.9	3.3	11.8	2.4	1	3.3		




L A K E E R I E
HH-12
HH-11
HH-10
HH-9
HH-8
HH-7
HH-6
HH-5
HH-4
HH-3
HH-2
HH-1
Huron Harbor 2014 sample locations
13
24
HU



LEGEND

HURON HARBOR LAKE ENTRANCE CHANNEL SAMPLING SITES HH-1 THROUGH HH 10

SCALE: NOT TO SCALE

Engineering & Environment, inc.	**Huron Harbor** *Huron Harbor Lake Entrance Channel Sampling Sites* *Huron Harbor, Ohio* May 2005	**Figure 1**

Particle Size Distribution of River Channel Sediments, Lorain Harbor, Ohio

	River Channel								
EEI 2005	**LR-1**	**LR-2**	**LR-3**	**LR-4**	**LR-5**	**LR-6**	**LR-7**	**LR-8**	**LR-9**
Clay (%)	24.8	48.8	37.3	34.4	46.2	52.8	64.7	33.1	23.6
Silt (%)	41.3	39.1	56.2	55.4	51.7	42.7	29.4	50.7	23.7
Sand (%)	33.9	10.7	6.5	10.2	2.1	4.4	5.9	14.9	47.6
Gravel (%)	0	1.4	0	0	0	0.1	0	1.3	5.1

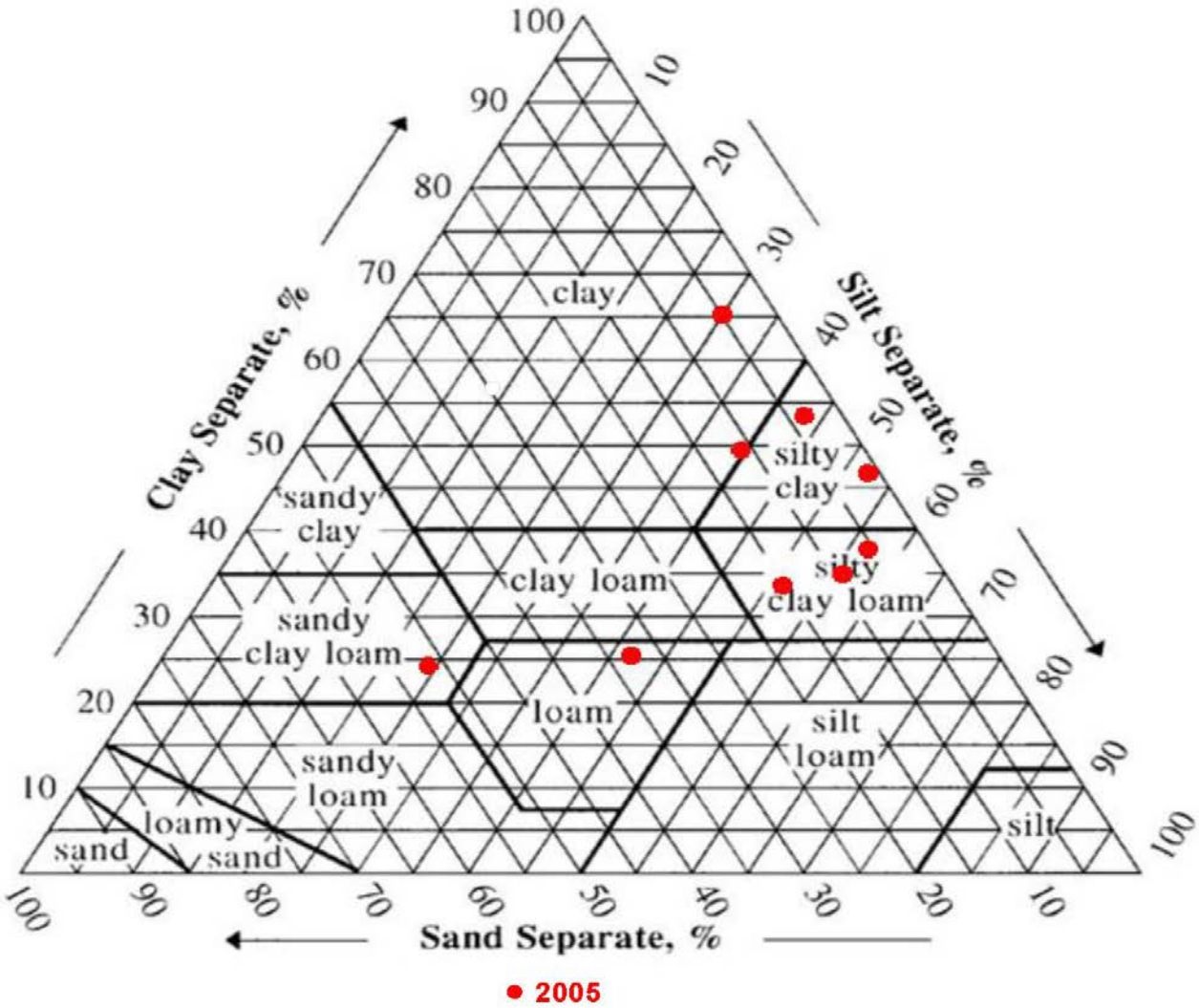
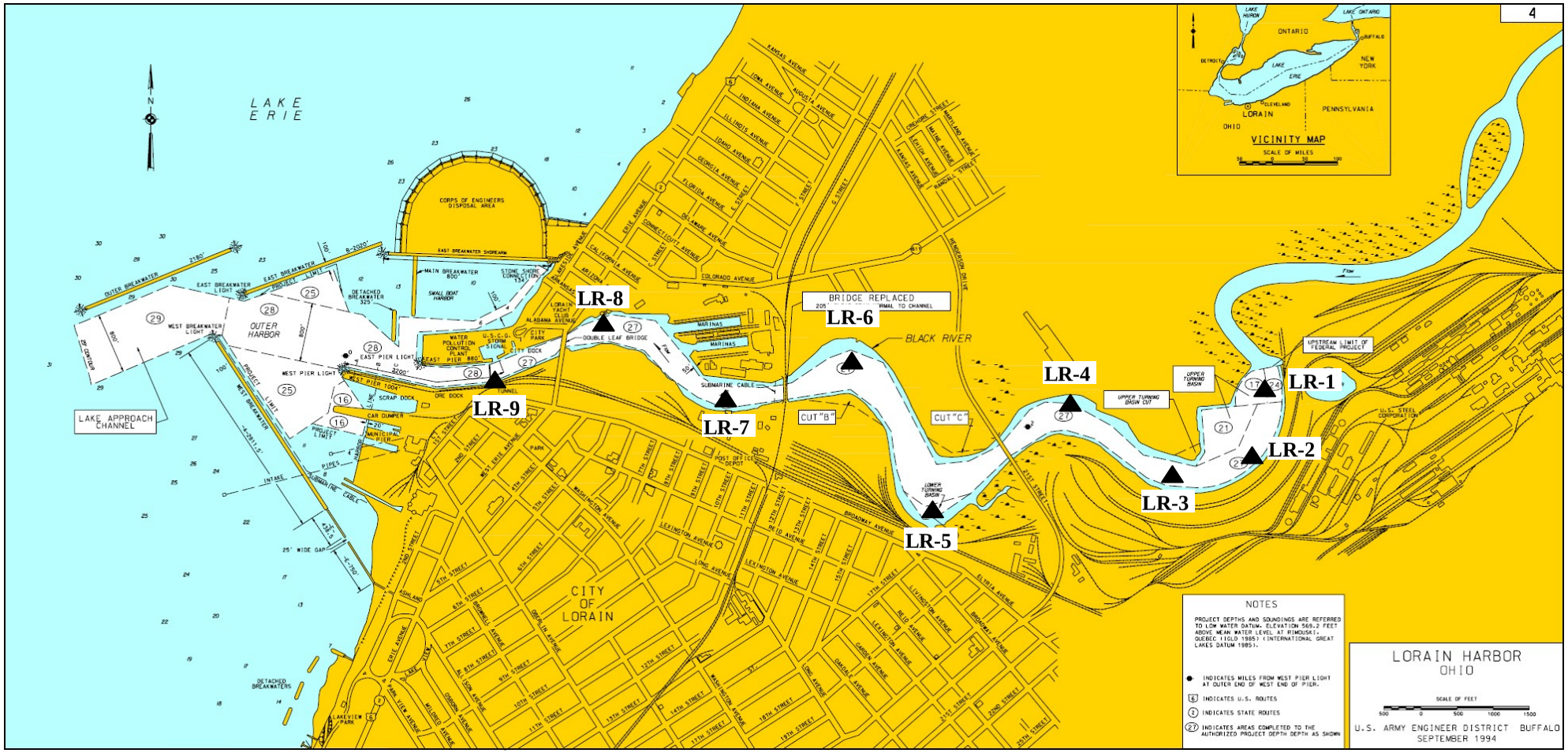
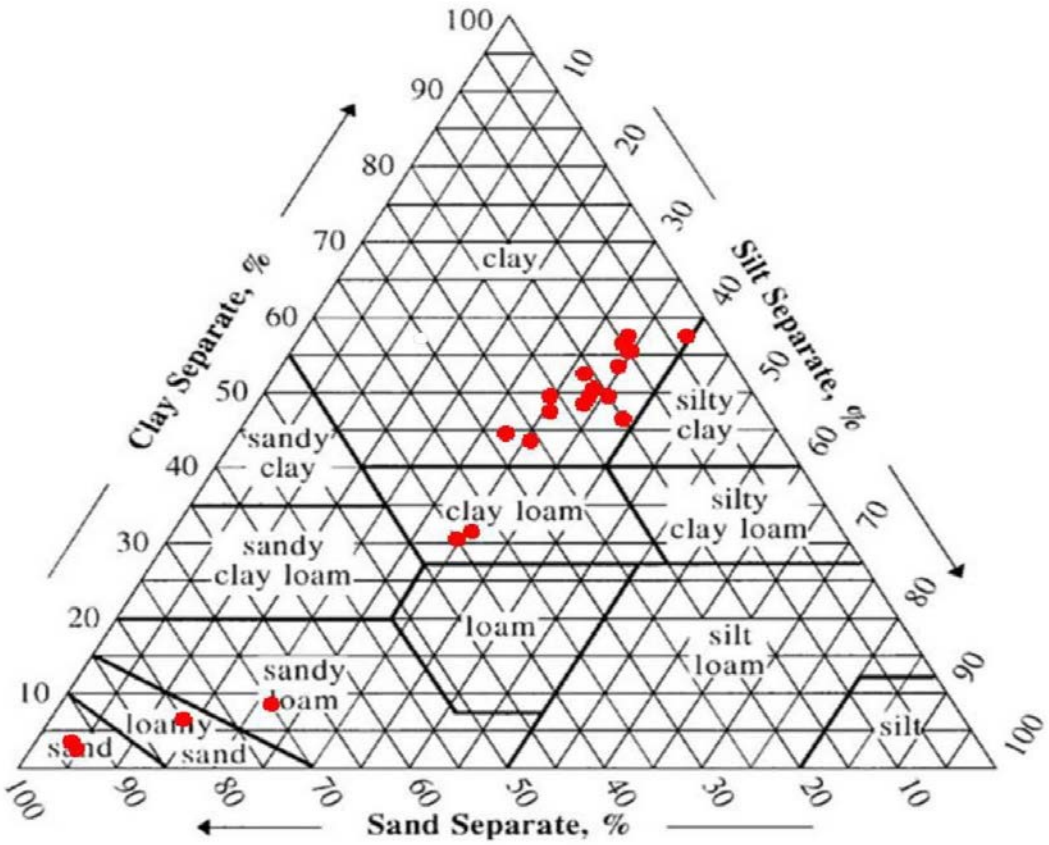


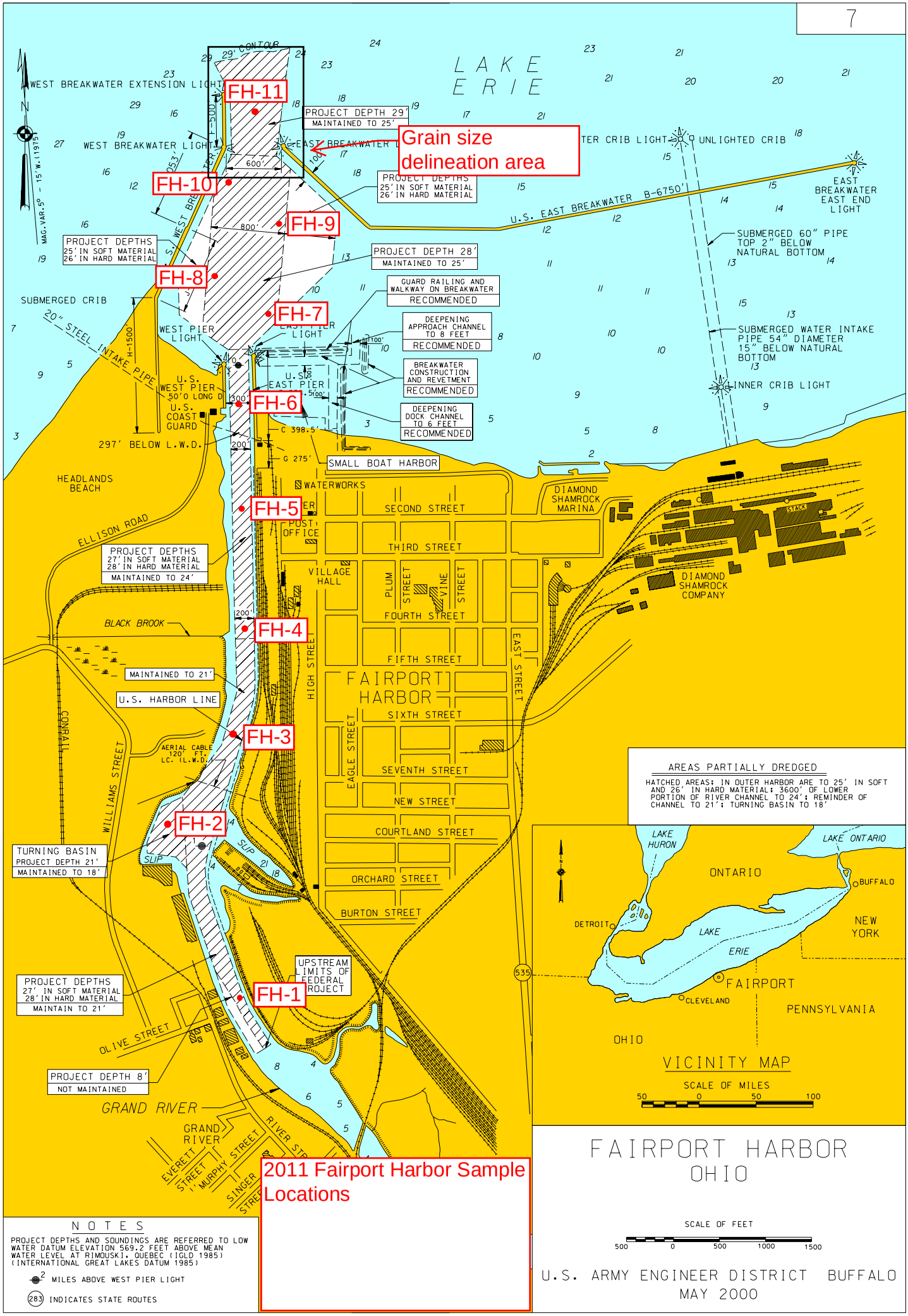
FIGURE 1. Sites for the 2001/2005 sediment sampling of the Lorain Harbor, Ohio, River Channel.



Particle Size Distribution of Federal Navigation Channel Sediments, Fairport Harbor, Ohio

	Harbor Entrance Channel					Outer Harbor Channel				Harbor Entrance Channel	River Channel					
TTL Associates 2011	**FPS-1**	**FPS-2**	**FPS-3**	**FPS-4**	**FPS-5**	**FH-7**	**FH-8**	**FH-9**	**FH-10**	**FH-11**	**FH-1**	**FH-2**	**FH-3**	**FH-4**	**FH-5**	**FH-6**
Clay (%)	3	30	43	48	47	49	57	55	53	56	44	53	49	53	57	52
Silt (%)	3	29	30	33	30	35	39	35	34	33	27	34	29	34	33	31
Sand (%)	93	41	27	19	23	16	4	10	13	11	29	13	22	13	10	17
Gravel (%)	1	0	0	0	0	0	0	0.7	0	0	0	0	0	0	0	0



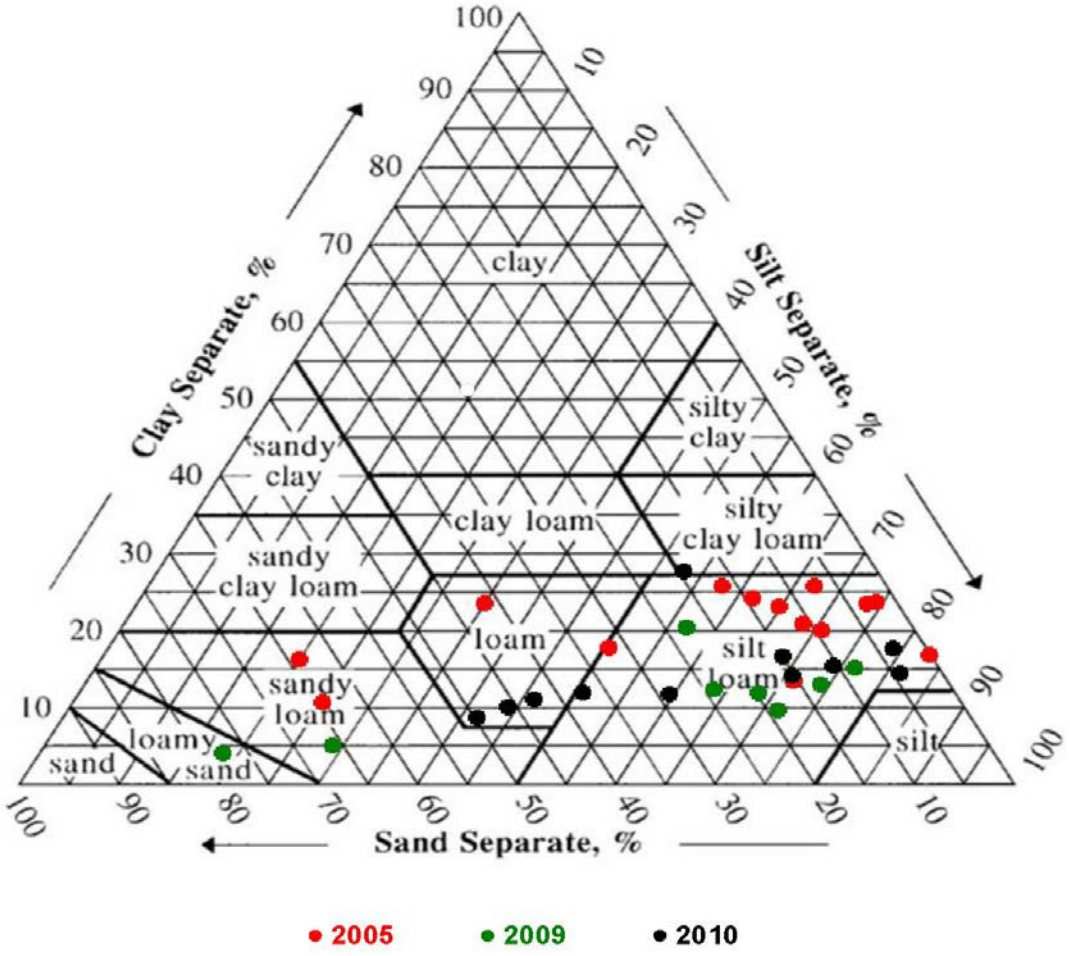

LAKE ERIE
WEST BREAKWATER EXTENSION LIGHT
WEST BREAKWATER LIGHT
EAST BREAKWATER LIGHT
TER CRIB LIGHT
UNLIGHTED CRIB
EAST BREAKWATER EAST END LIGHT
U.S. EAST BREAKWATER B-6750'
SUBMERGED 60" PIPE TOP 2" BELOW NATURAL BOTTOM
SUBMERGED WATER INTAKE PIPE 54" DIAMETER 15" BELOW NATURAL BOTTOM
INNER CRIB LIGHT
MAG. VAR. 5° - 15' W. (1975)
N
29' CONTOUR
FH-11
FH-10
FH-9
FH-8
FH-7
FH-6
FH-5
FH-4
FH-3
FH-2
FH-1
Grain size delineation area
PROJECT DEPTH 29' MAINTAINED TO 25'
PROJECT DEPTHS 25' IN SOFT MATERIAL 26' IN HARD MATERIAL
PROJECT DEPTHS 25' IN SOFT MATERIAL 26' IN HARD MATERIAL
PROJECT DEPTH 28' MAINTAINED TO 25'
GUARD RAILING AND WALKWAY ON BREAKWATER RECOMMENDED
DEEPENING APPROACH CHANNEL TO 8 FEET RECOMMENDED
BREAKWATER CONSTRUCTION AND REVETMENT RECOMMENDED
DEEPENING DOCK CHANNEL TO 6 FEET RECOMMENDED
SUBMERGED CRIB
20" STEEL INTAKE PIPE
WEST PIER LIGHT
EAST PIER LIGHT
U.S. WEST PIER 50'0 LONG
U.S. EAST PIER
U.S. COAST GUARD
297' BELOW L.W.D.
C 398.5'
G 275'
SMALL BOAT HARBOR
WATERWORKS
POST OFFICE
VILLAGE HALL
HEADLANDS BEACH
ELLISON ROAD
PROJECT DEPTHS 27' IN SOFT MATERIAL 28' IN HARD MATERIAL MAINTAINED TO 24'
BLACK BROOK
MAINTAINED TO 21'
U.S. HARBOR LINE
CONRAIL
WILLIAMS STREET
AERIAL CABLE 120' FT. L.C. (L.W.D.)
TURNING BASIN PROJECT DEPTH 21' MAINTAINED TO 18'
SLIP
PROJECT DEPTHS 27' IN SOFT MATERIAL 28' IN HARD MATERIAL MAINTAIN TO 21'
OLIVE STREET
PROJECT DEPTH 8' NOT MAINTAINED
GRAND RIVER
EVERETT STREET
MURPHY STREET
SINGER STREET
UPSTREAM LIMITS OF FEDERAL PROJECT
SECOND STREET
THIRD STREET
FOURTH STREET
FIFTH STREET
SIXTH STREET
SEVENTH STREET
NEW STREET
COURTLAND STREET
ORCHARD STREET
BURTON STREET
PLUM STREET
VINE STREET
HIGH STREET
EAST STREET
EAGLE STREET
FAIRPORT HARBOR
DIAMOND SHAMROCK MARINA
DIAMOND SHAMROCK COMPANY
STACK
AREAS PARTIALLY DREDGED
HATCHED AREAS: IN OUTER HARBOR ARE TO 25' IN SOFT AND 26' IN HARD MATERIAL; 3600' OF LOWER PORTION OF RIVER CHANNEL TO 24'; REMINDER OF CHANNEL TO 21'; TURNING BASIN TO 18'
LAKE HURON
LAKE ONTARIO
ONTARIO
BUFFALO
DETROIT
NEW YORK
LAKE ERIE
FAIRPORT
CLEVELAND
PENNSYLVANIA
OHIO
535
VICINITY MAP
SCALE OF MILES
50 0 50 100
FAIRPORT HARBOR
OHIO
SCALE OF FEET
500 0 500 1000 1500
U.S. ARMY ENGINEER DISTRICT BUFFALO
MAY 2000
NOTES
PROJECT DEPTHS AND SOUNDINGS ARE REFERRED TO LOW WATER DATUM ELEVATION 569.2 FEET ABOVE MEAN WATER LEVEL AT RIMOUSKI, QUEBEC (IGLD 1985) (INTERNATIONAL GREAT LAKES DATUM 1985)
2 MILES ABOVE WEST PIER LIGHT
283 INDICATES STATE ROUTES
2011 Fairport Harbor Sample Locations

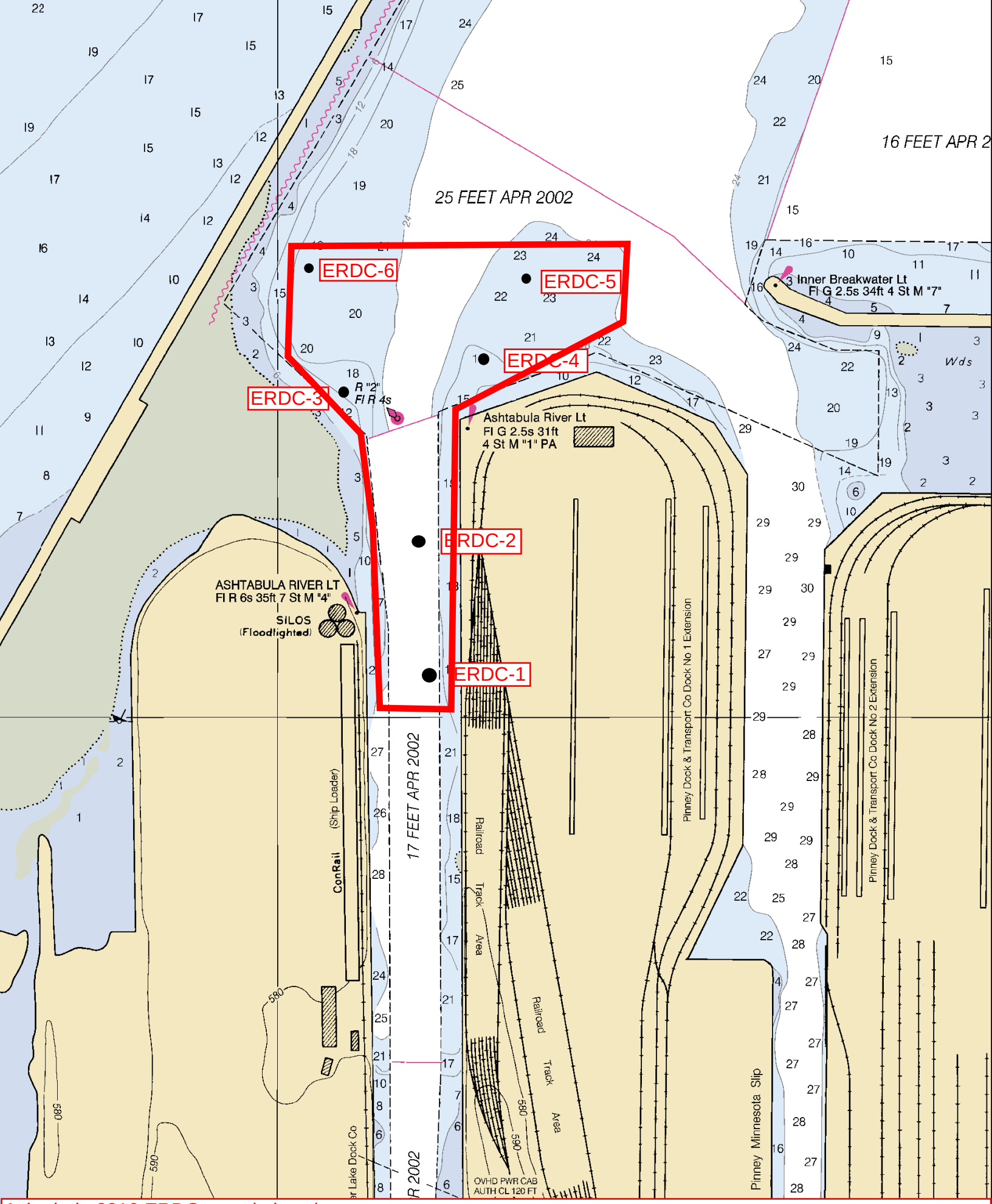
Particle Size Distribution of Harbor Management Unit Composite Samples and Federal Navigation Channel Sediments, Ashtabula Harbor, Ohio

	Sampling Sites								
USACE 2010	**ERDCMU**	**ACEMU-1**	**ACEMU-2**	**EPAMU-1**	**EPAMU-2**	**EPAMU-3**	**URCMU-1**	**URCMU-2**	**URCMU-3**
Clay (%)	9.5	17.1	14.9	13.9	13.6	11.2	10.5	8.1	11.4
Silt (%)	43.5	78.5	73.6	80.8	70.1	58.9	45.6	41.1	50.1
Sand (%)	47	4.4	11.5	5.3	16.3	29.9	43.9	50.8	38.5

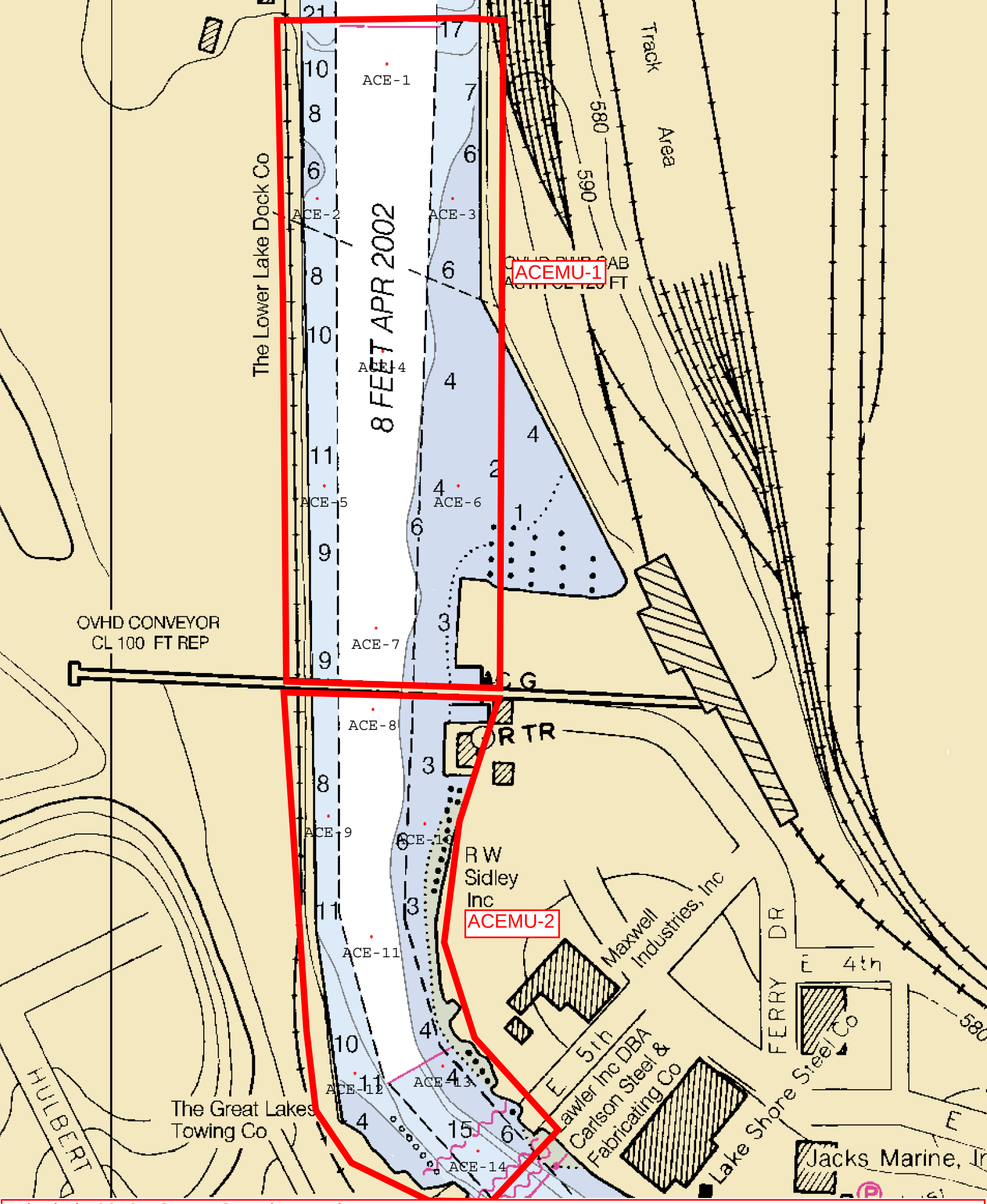
ARDL 2009	**AMU-1**	**AMU-2**	**AMU-3**	**AMU-4**	**AMU-5**	**AMU-6**
Clay (%)	10.4	4	12.6	7.9	10.4	2.1
Silt (%)	71.7	27.8	74	69.7	61.7	16.4
Sand (%)	12	66.3	7.5	18.7	23.7	77.3
Gravel (%)	0	0.3	0	0.1	0	0

EEI 2005	**AH-3**	**AH-4**	**AH-5**	**AH-6**	**AH-12**	**AH-13**	**AH-14**	**AH-15**
Clay (%)	12.9	22.9	10.1	20.3	25.2	23.6	25.2	22.6
Silt (%)	70.6	73	24.5	67.8	66.5	61.1	57.2	64.3
Sand (%)	16.5	4.1	65.4	11.9	8.3	15.3	17.6	13.1

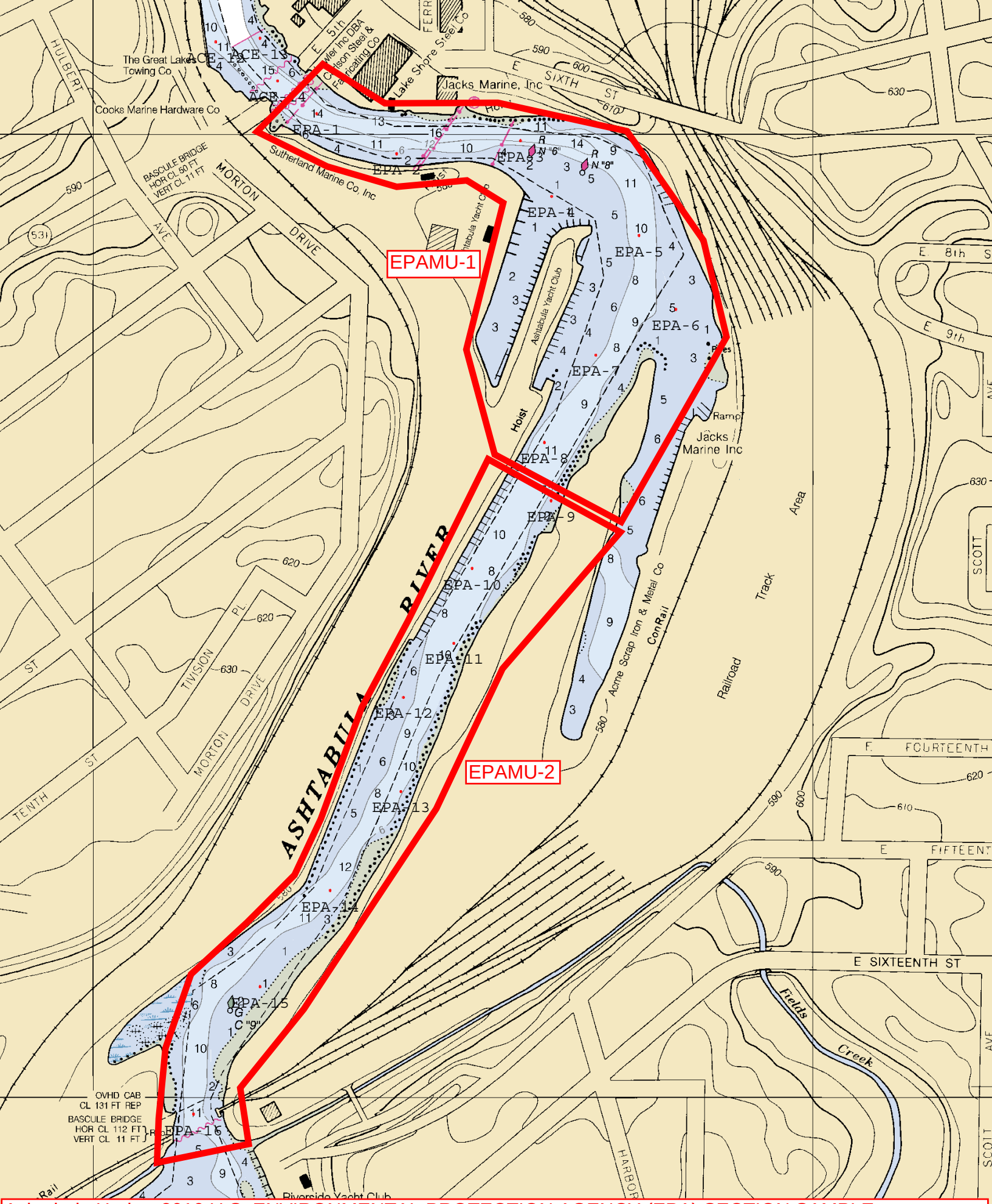




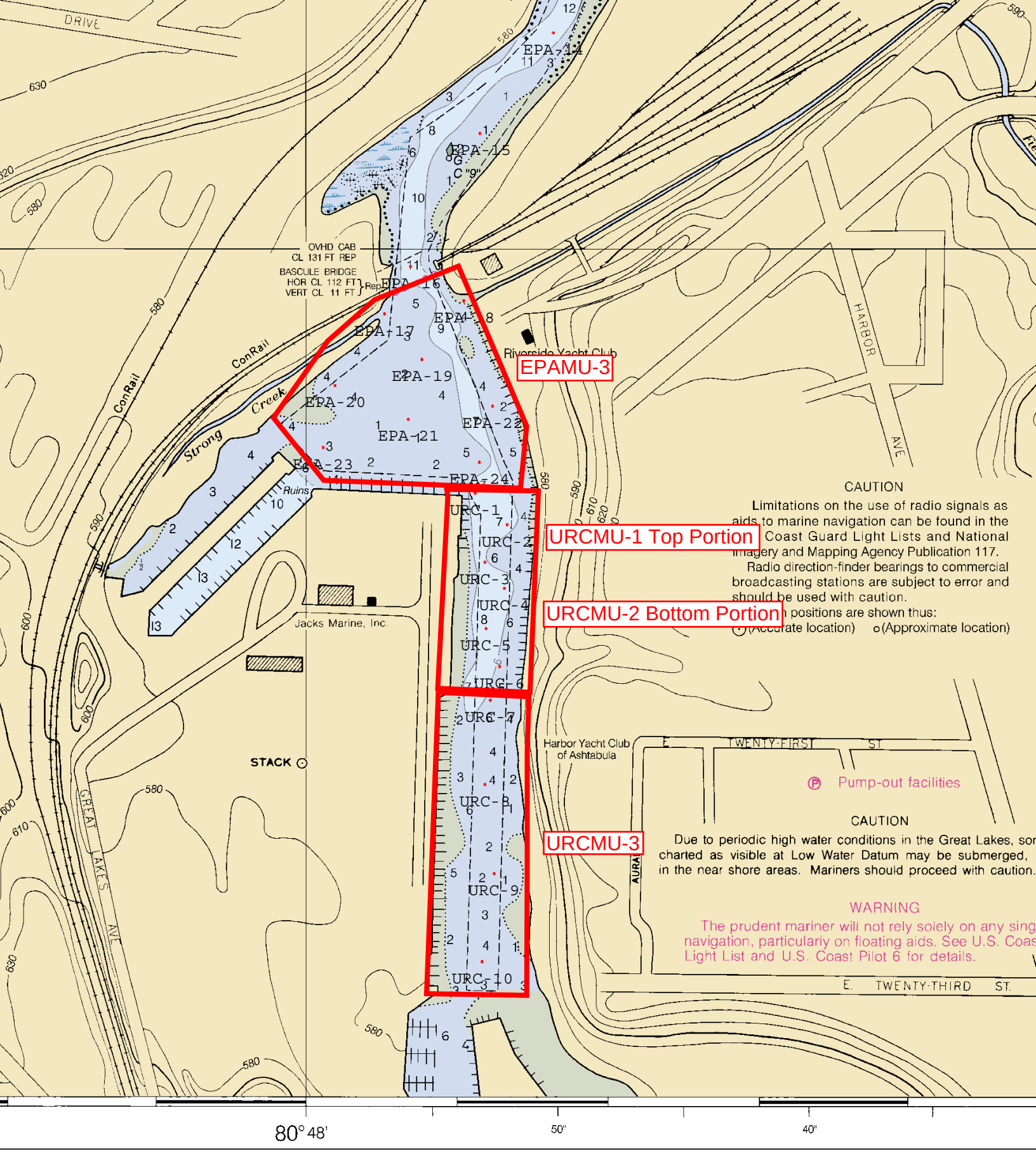
Ashtabula 2010 ERDC sample locations



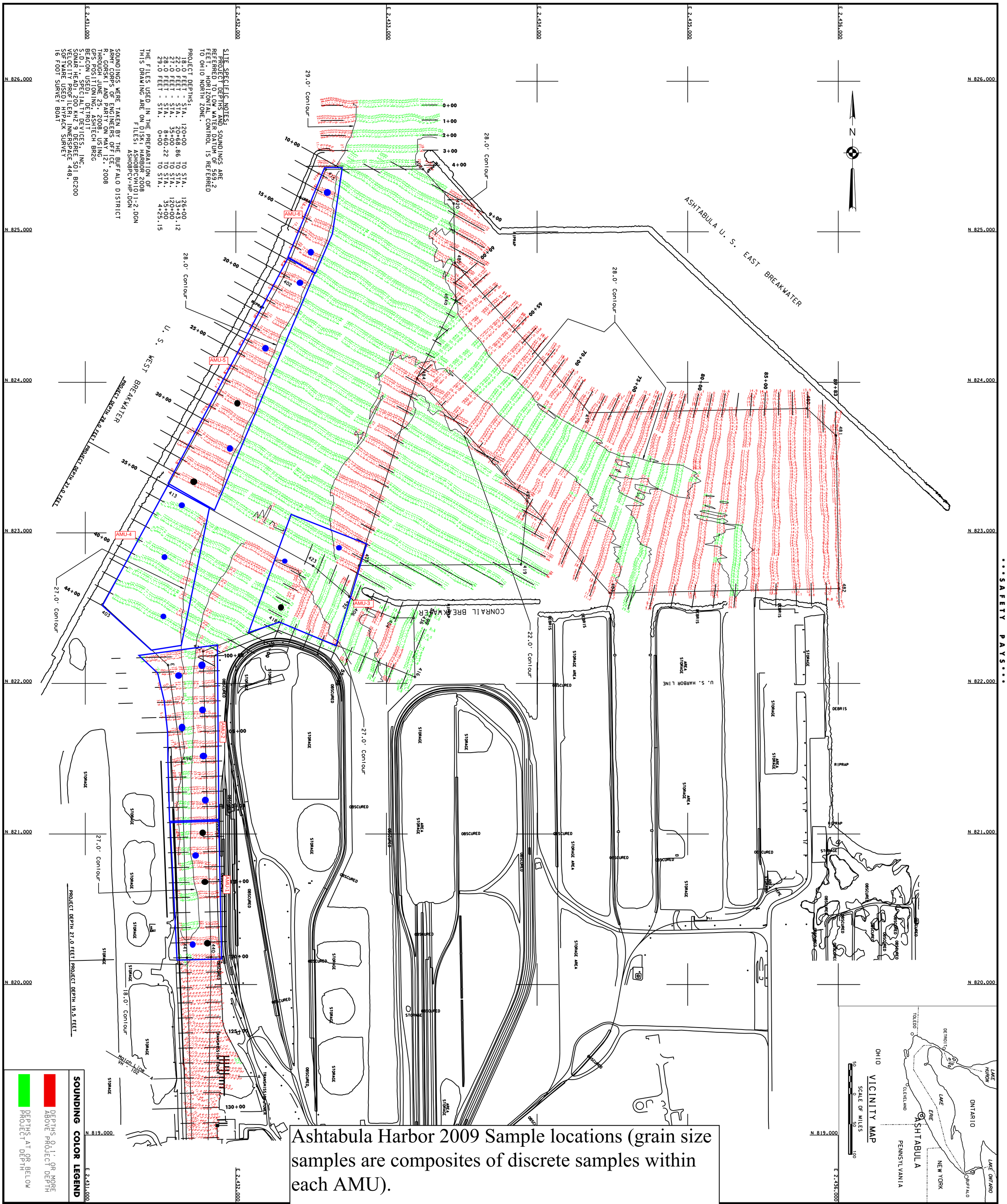
Ashtabula 2010 ACEMU Sample Locations



Ashtabula Harbor 2010 U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) SECTION SAMPLE LOCATIONS



Ashtabula Harbor 2010 UPPER RIVER CHANNEL (URC) SECTION SAMPLE LOCATIONS (also includes EPAMU-3)



Ashtabula Harbor 2009 Sample locations (grain size samples are composites of discrete samples within each AMU).

Sheet reference number: VH - 101

Sheet 1 of 2

08S-ASH-1/1

ASHTABULA HARBOR, OHIO

PROJECT CONDITION SOUNDINGS 2008

SCALE: 1" = 200'

SCALE OF FEET 50 0 100 200

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NEW YORK 14207-3199

Checked by:
Reviewed by:
Chief, Survey Unit
Approved: Date:
Chief, NY/PA Navigation and Maintainence Section

General Notes

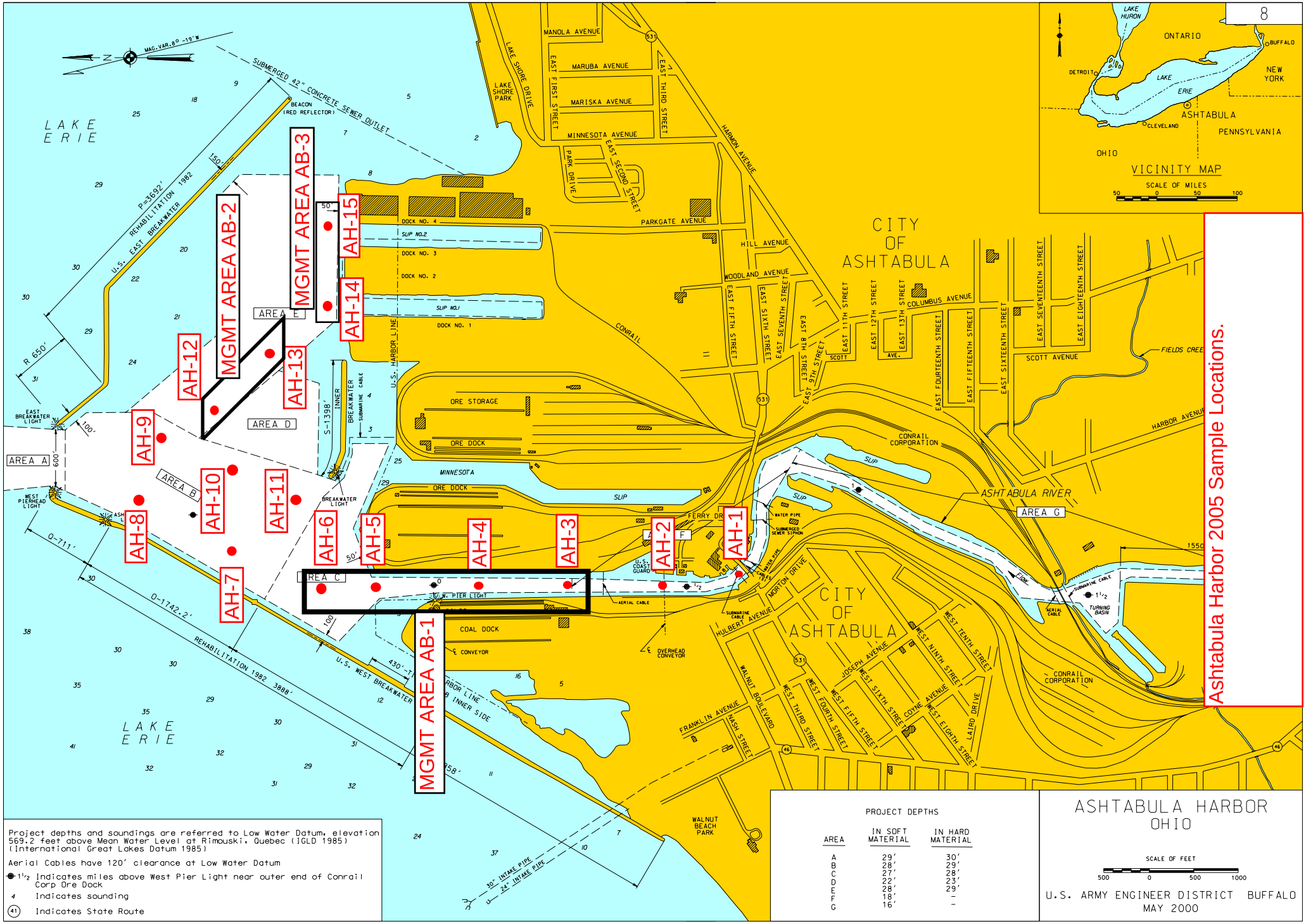
The information depicted on the map represents the results of surveys made on the date indicated and can only be considered as indicating the general condition at that time. Unless otherwise noted on this map, all depths and soundings are in feet and referred to the International Great Lakes Datum 1985 (IGLD 1985) and all horizontal positions are referred to North American Datum 1983 (NAD83). See the Site Specific Notes area for appropriate datums. To view a color version of this map, point a web browser to http://www.lrb.usace.army.mil/waterways/survey/survey.html.
This drawing was prepared using a CADD system. Scaling may be distorted.

US Army Corps of Engineers
Buffalo District

SUPPORT VALUE ENGINEERING - IT PAYS

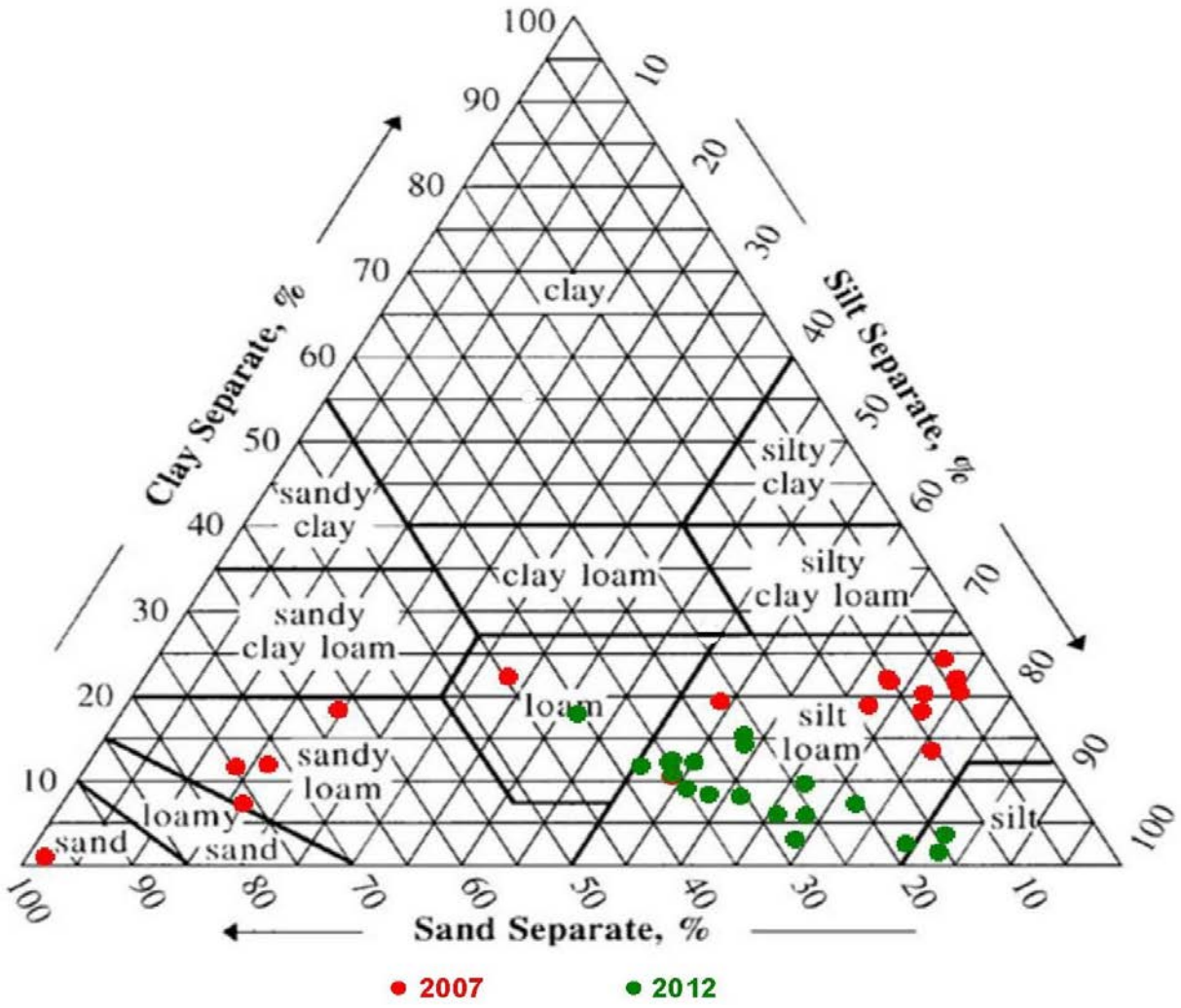
SAFETY PAYS

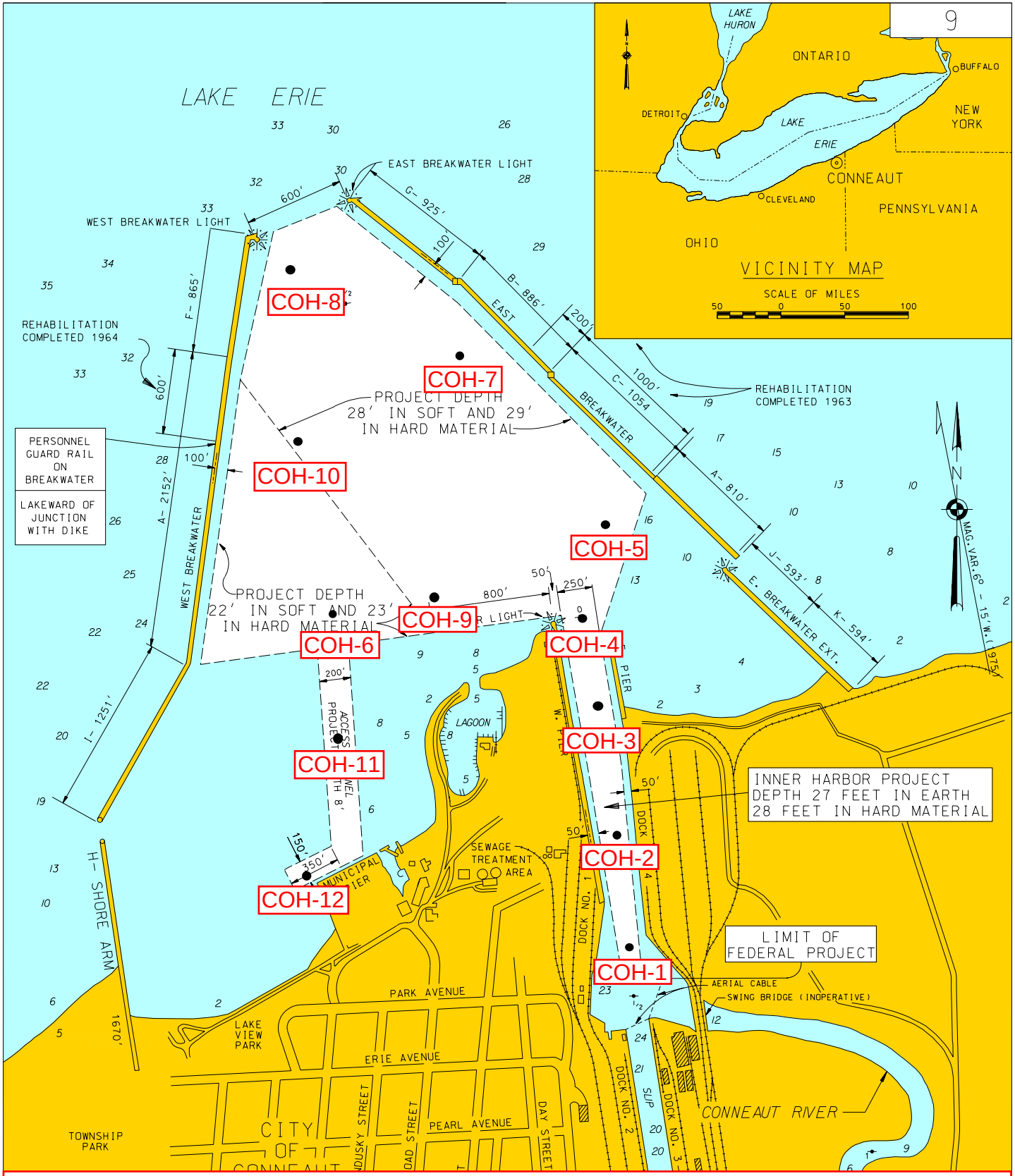
ash08pcvh101-2.dgn 7/8/2008 12:12:18 PM


8
LAKE ERIE
MAG. VAR. 8° -19' W
SUBMERGED 42" CONCRETE SEWER OUTLET
BEACON (RED REFLECTOR)
P=3692'
REHABILITATION 1982
U.S. EAST BREAKWATER
R 650'
EAST BREAKWATER LIGHT
AREA A
AREA B
AREA C
AREA D
AREA E
AREA G
WEST PIERHEAD LIGHT
0-711'
0-1742.2'
REHABILITATION 1982 3898'
U.S. WEST BREAKWATER
INNER SIDE
S-1398'
INNER BREAKWATER
SUBMARINE CABLE
BREAKWATER LIGHT
W.W. PIER LIGHT
U.S. HARBOR LINE
DOCK NO. 4
SLIP NO.2
DOCK NO. 3
DOCK NO. 2
SLIP NO.1
DOCK NO. 1
ORE STORAGE
ORE DOCK
MINNESOTA
SLIP
COAL DOCK
CONVEYOR
OVERHEAD CONVEYOR
AERIAL CABLE
WATER PIPE
SUBMERGED SEWER SIPHON
U.S. COAST GUARD
FERRY DR
30" INTAKE PIPE
24" INTAKE PIPE
WALNUT BEACH PARK
LAKE SHORE PARK
LAKE SHORE DRIVE
MANOLA AVENUE
MARUBA AVENUE
MARISKA AVENUE
MINNESOTA AVENUE
EAST FIRST STREET
EAST THIRD STREET
EAST SECOND STREET
PARK DRIVE
HARMON AVENUE
PARKGATE AVENUE
HILL AVENUE
WOODLAND AVENUE
CONRAIL
CITY OF ASHTABULA
EAST FIFTH STREET
EAST SIXTH STREET
EAST SEVENTH STREET
EAST 8TH STREET
EAST 9TH STREET
EAST 11TH STREET
EAST 12TH STREET
EAST 13TH STREET
COLUMBUS AVENUE
SCOTT AVENUE
EAST FOURTEENTH STREET
EAST FIFTEENTH STREET
EAST SIXTEENTH STREET
EAST SEVENTEENTH STREET
EAST EIGHTEENTH STREET
FIELDS CREEK
HARBOR AVENUE
CONRAIL CORPORATION
ASHTABULA RIVER
TURNING BASIN
MORTON DRIVE
HULBERT AVENUE
JOSEPH AVENUE
COYNE AVENUE
WEST TENTH STREET
WEST NINTH STREET
WEST SIXTH STREET
WEST FIFTH STREET
WEST FOURTH STREET
WEST THIRD STREET
WALNUT BOULEVARD
LAIRD DRIVE
WEST EIGHTH STREET
FRANKLIN AVENUE
MASH STREET
LAKE HURON
ONTARIO
BUFFALO
DETROIT
LAKE ERIE
NEW YORK
ASHTABULA
CLEVELAND
PENNSYLVANIA
OHIO
VICINITY MAP
SCALE OF MILES
50 0 50 100
MGMT AREA AB-1
MGMT AREA AB-2
MGMT AREA AB-3
AH-1
AH-2
AH-3
AH-4
AH-5
AH-6
AH-7
AH-8
AH-9
AH-10
AH-11
AH-12
AH-13
AH-14
AH-15
Ashtabula Harbor 2005 Sample Locations.
Project depths and soundings are referred to Low Water Datum, elevation 569.2 feet above Mean Water Level at Rimouski, Quebec (IGLD 1985) (International Great Lakes Datum 1985)
Aerial Cables have 120' clearance at Low Water Datum
1½ Indicates miles above West Pier Light near outer end of Conrail Corp Ore Dock
4 Indicates sounding
41 Indicates State Route
PROJECT DEPTHS
AREA | IN SOFT MATERIAL | IN HARD MATERIAL
A | 29' | 30'
B | 28' | 29'
C | 27' | 28'
D | 22' | 23'
E | 28' | 29'
F | 18' | -
G | 16' | -
ASHTABULA HARBOR
OHIO
SCALE OF FEET
500 0 500 1000
U.S. ARMY ENGINEER DISTRICT BUFFALO
MAY 2000

Particle Size Distribution of Federal Navigation Channel Sediments, Conneaut Harbor, Ohio

	Harbor Area Sites											
RTI 2012	**COH-1**	**COH-2**	**COH-3**	**COH-4**	**COH-5**	**COH-6**	**COH-7**	**COH-8**	**COH-9**	**COH-10**	**COH-11**	**COH-12**
Clay (%)	17.3	11.2	10.3	11.7	13.7	14.9	11.9	11.7	11.9	7.8	3.1	8.5
Silt (%)	41.0	49.9	53.2	54.5	58.1	57.4	52.4	52.2	52.4	57.8	81.7	55.4
Fine Sand (%)	1.4	2.4	3.2	2.0	0.8	2.3	1.3	4.9	0.3	1.5	14.9	2.8
Meduim Sand (%)	0.5	0.4	0.4	0.1	0.3	0.1	0.2	0.2	0.0	0.1	0.0	0.3
Coarse Sand (%)	36.9	33.4	30.2	31.7	27.1	25.3	33.8	31.0	35.4	32.8	0.3	33.0
Fine Gravel (%)	2.9	2.7	2.7	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0
Total Fines (Silt and Clay)	58.3	61.1	63.5	66.2	71.8	72.3	64.3	63.9	64.3	65.6	84.8	63.9
Total Sand and Gravel	41.7	38.9	36.5	33.8	28.2	27.7	35.7	36.1	35.7	34.4	15.2	36.1
EEI 2007												
Clay (%)	23.8	18.3	21.5	19.9	17.6	13.0	21.5	18.8	21.2	19.7	10.0	21.2
Silt (%)	71.2	67.1	73.5	74.6	72.3	75.5	67.2	53.3	73.6	71.4	53.3	67.6
Fine Sand (%)	4.9	14.2	4.9	5.4	10.0	11.2	9.9	27.1	5.1	8.6	36.5	10.7
Meduim Sand (%)	0.1	0.4	0.1	0.1	0.1	0.3	0.9	0.8	0.1	0.2	0.2	0.4
Coarse Sand (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.1	0.0	0.1





2012 CONNEAUT HARBOR FEDERAL NAVIGATION CHANNEL SEDIMENT SAMPLE LOCATIONS.

NOTES

PROJECT DEPTH AND SOUNDINGS ARE REFFERED TO LOW WATER DATUM ELEVATION 569.2 FEET ABOVE MEAN WATER LEVEL AT RIMOUSKI, QUEBEC (IGLD 1985) (INTERNATIONAL GREAT LAKES DATUM 1985)

MILES FROM WEST PIER LIGHT

(7) INDICATES STATE ROUTES

CONNEAUT HARBOR
OHIO

SCALE OF FEET
500 0 500 1000 1500

U.S. ARMY ENGINEER DISTRICT BUFFALO
MAY 2000

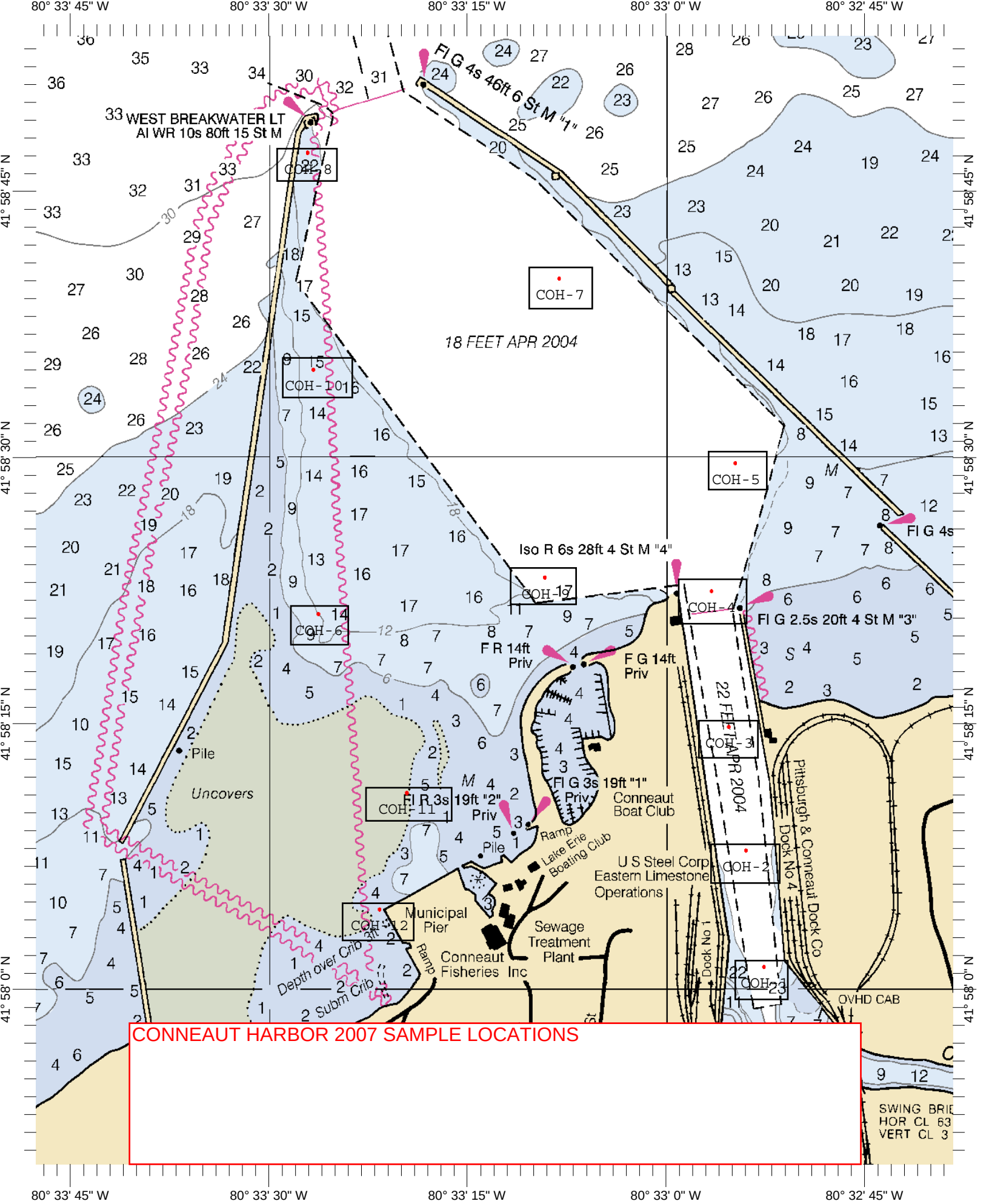


Chart Name: CONNEAUT HARBOR OHIO
Chart ID: 14824_2
Top Left: 41° 58' 53" N 80° 33' 47" W
Bottom Right: 41° 57' 50" N 80° 32' 38" W

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