ILLINOIS BEACH STATE PARK, LAKE COUNTY, ILLINOIS
SECTION 204 BENEFICIAL USE OF DREDGED MATERIAL

APPENDIX D – GEOTECHNICAL ENGINEERING

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GEOTECHNICAL APPENDIX
APPENDIX D

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I. INTRODUCTION

1. The Illinois coast of Lake Michigan extends 60 miles along the southernmost part of the western shore of the lake. This coast borders the most densely populated area in the Great Lakes region, and includes some of the most engineered and altered coastal settings in the region. Unique along the Illinois coast is its far northern segment that includes Illinois Beach State Park. This park preserves the last remaining segments of Lake Michigan shoreline in the state that are free of any coastal engineering, and the last remaining expanse of coastal dunes and wetlands. Illinois Beach State Park is part of a distinct coastal landform called the Zion beach-ridge plain. This young, dynamic, and migratory landform results in this state park being in a setting, and having ongoing geologic processes, unlike any other park in Illinois.

2. The Illinois Department of Natural Resources (IDNR) has the role of stewardship for the state park and the adjoining North Point Marina. Together the park and marina facilities occupy 6.5 miles of the 9.7-mile shore between the Wisconsin-Illinois state line and Waukegan harbor. The coastal geology and dynamics of this setting produce both deficits and surpluses of coastal sand from place to place. To the south of the state park, a surplus of coastal sand requires periodic maintenance dredging to keep channels open for power plant cooling water at the Waukegan Generating Station and navigation into Waukegan harbor.

3. The proposed project involves the beneficial use of dredged material in support of beach nourishment along the Illinois Beach State Park shoreline, shown in Figure D-1. The nearshore lake area consists of sand, gravel and cobble substrate overlaying a clay lens. Littoral input to the area is not sufficient to accommodate the amount of erosion currently experienced, resulting in a net loss of shoreline and a gradual decrease in the dry beach width. The goal of the project is to provide a recommendation for the most viable approach for utilizing the dredged material for beach nourishment, specifically through nearshore and beach placement.

4. Dredge material for the two planning measures is proposed to be sourced from the Waukegan Harbor Approach Channel, the location of which is shown in Figure D-2.

Figure D - 1: Illinois Beach State Park Map

Figure D - 2: Waukegan Harbor Approach Channel Dredging Location

5. The dredged sediment proposed by the planning measures is to be sourced from the Waukegan Harbor Approach Channel, and is not considered contaminated. The Approach Channel is located lakeward from the previously studied Outer Harbor, and material from the Approach Channel is dredged annually. Sediment in the area of the Approach Channel is in the littoral drift zone, as is sediment in the two proposed placement areas to the north. Placement in the littoral zone has been the disposal method for Waukegan Approach Channel and Advance Maintenance Area (lakeward to the north of the Approach Channel) sediment for more than a decade. Several placement areas have been used; both north and south of the harbor (see Figure 3 below). The proposed project will include placing sediment dredged from Waukegan Harbor near Illinois Beach State Park (the northern placement area in Figure 3).

6. The Littoral Nearshore Placement (LNP) measure proposes that sandy material dredged from the Waukegan Harbor Approach Channel would be transported via barge approximately 8-miles from Waukegan Harbor to the feeder cell where it would be placed into 18-20 feet of water using a bottom dump scow. The deposited sand would gradually migrate south along the nearshore zone via longshore sediment transport where it would counterbalance the annual littoral sediment deficit. The dredged material would be placed and monitored in accordance with the existing dredging permit. This measure

essentially replicates the current disposal practices utilized for Waukegan Harbor Approach Channel dredged material.

7. The Direct Beach Placement (DBP) measure proposes placing sandy dredged material directly onto the beach to restore and replenish the degraded beach habitats in highly erosive areas. This measure would stabilize beach and dune habitat and provide erosion protection, particularly during high-energy storm events. The direct beach placement would potentially target two areas within the North Unit where erosion and habitat loss is most prevalent. The northern placement area would consist of a 2,000 foot stretch of unprotected shoreline located immediately south of North Point Marina, and the southern placement area would consist of a 3,000 foot stretch located south of 17th Street. Sandy dredged material from the Waukegan Approach Channel would be transferred from the dredger to an upland staging area at Waukegan Harbor. The material would be allowed to briefly drain then loaded onto dump trucks where it would be transported via surface roads to the placement areas where it would be placed and spread with a bulldozer or other appropriate earth moving equipment

II. REGIONAL GEOLOGY

8. The geology of the Chicago area is largely a consequence of a series of continental glacial advances and retreats. During the most recent glaciation, the Wisconsinan, the area was covered by several thousand feet of ice of the Lake Michigan Lobe of the Laurentide ice sheet. As a result, the area has been mantled by surficial deposits up to 300 feet thick, that were deposited by glaciers and higher level stages of Lake Michigan. Bedrock is generally not exposed in the Chicagoland area, except in quarries and local outcroppings, as the rock strata is typically covered by glacial drift. The rock stratigraphy is composed of a thick sequence of sedimentary rocks consisting of dolomitic limestone, dolomite, shale, and sandstone. The Chicago area is located on the eastern flank of a broad structural arch known as the Kankakee Arch. The Kankakee Arch separates the Michigan and Illinois structure basins. Paleozoic strata in northeastern Illinois are structurally a part of the western rim of the Michigan Basin. The overall southeasterly dip of the rock strata is generally about 10 to 15 feet per mile. In addition to these natural processes, the Chicago lakefront has been extensively modified during the last 150 years from man-made structures and filling operations.

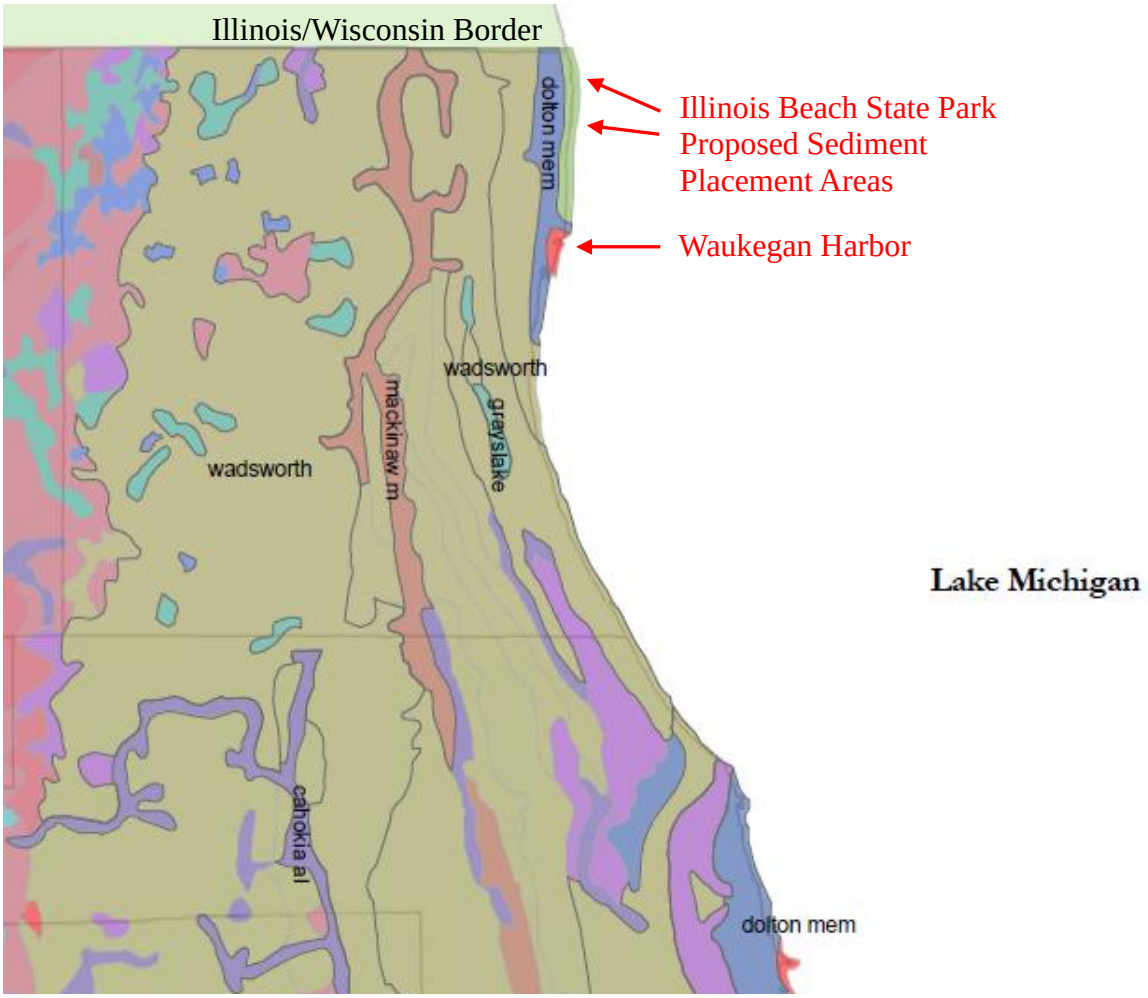


Figure D - 3: Illinois Surficial Geology Map

Overburden Geology

9. Illinois Beach State Park occupies a prominent coastal feature called a beach-ridge plain. This type of coastal landform occurs worldwide along sandy coasts. Beach-ridge plains consist of linear, generally coast-parallel mounds of sand and/or gravel (adjacent to each other) that have been built up by wave action to extend the coast outward into the adjacent ocean or lake. The Zion beach-ridge plain extends along the Lake Michigan shore for nearly 18 miles from Kenosha, Wisconsin, to North Chicago, Illinois. The plain has a maximum width of about 1 mile opposite Zion, Illinois, and has thus been named after this city. The plain defines one of the three different coastal/geomorphic zones along the Illinois coast and has a geologic history very different from the rest of the Illinois coast.

10. A characteristic of a beach-ridge plain is a "washboard" topography of sub-parallel ridges separated by low areas called swales. The ridges and swales of the Zion beach-ridge plain are best seen in the South Unit of the state park, and best viewed from the air. The difference in elevation between the ridges and swales in the state park is generally no more than 10 feet, except where sand dunes built atop the ridges add to their height. The ridges are typically formed by storm waves that have enough energy to move large volumes of sediment and deposit sediment in a mound (i.e., ridge) that can have a lateral continuity for great distances along the shore. Although the topography consists of multiple ridges and swales, this type of coastal landform is called a plain because the elevation difference between tops of the ridges and bottom of the swales is minor compared to the length and breadth of the overall landform.

11. In general, other than the major stage elevation changes, the Lake Plain area along the coast of Lake Michigan has been relatively flattened over time by wave erosion and minor depositions in low areas, and has remained relatively uneroded by modern streams and rivers that flow above. The Lake Plain region is composed of the Equality Formation materials, consisting of silt, sand, gravel, and clay deposits that had accumulated in the glacial lakes over time. The Equality Formation is subdivided into two members; the Dolton Member and the Carmi Member.

12. The Dolton member is primarily sand material with beds of silt, pebbly sand, and gravel. The Dolton member materials, which are generally 10 ft in thickness, are found in ridged areas that were once spits, beaches, or bars of the historic lakes. Pebbles and gravels are mostly found in narrow belts along the shorelines where till, silt, and clay materials were eroded away. The Carmi Member is primarily composed of silt with well-bedded fine sand and clay. The thickness of this material is generally a few feet, but it has been found to be as thick as 20 feet in some areas.

13. Overlaying the Equality Formation is generally Richland Loess or Modern Soil. It is noted that there are some locations where Wisconsonian-Holocene formations overlay the Equality formation, however, the Wisconsonian-Holocene formation is not found in the general vicinity of the proposed site, and thus is not further discussed in this report.

14. The locations of the Dolton and Carmi members with respect to the sites referenced in this appendix are included in Figure D-3. The Richland Loess is not mapped because it is a relatively thin layer with irregular distribution.

15. Most of the unconsolidated sediments along the Illinois shoreline were originally deposited by the Lake Michigan Lobe Ice Sheet or were deposited as lake-bottom and near-shore deposits of the ancient Lake Chicago and its successors. Glacial and lacustrine processes resulted in the deposition of three types of materials: recent deposits of fluvial and eolian sand, lacustrine silt and clay, and till-related deposits. In the Chicago area, the thickness of unconsolidated sediments generally averages between 40 and 90 feet.

16. Other sediments range from lacustrine or glaciofluvial sediments of the Equality Formation to eolian sediments of the Parkland Sand. The Equality Formation is subdivided into the Carmi and Dolton Members that typically grade laterally into each other and are superimposed in some areas. The Carmi Member is primarily silt and clay with localized peat beds, generally laminated or well-bedded lake deposits found at or near the ground surface. The Dolton Member is primarily sand, but contains thin beds of peat and muck as well as discontinuous lenses of sand and gravel. These sediments consist of shore and shallow-water lacustrine deposits, commonly found in ridges defining former spits and beaches.

17. The majority of the glacial deposits are of the Wedron Formation. The Wedron Formation includes till-related deposits and gravel, sand, and silt of the Woodfordian Substage. The Wadsworth Till is the oldest of the tills in the Wedron Formation. The Wadsworth is generally a gray silty clay with localized silt seams. The Wadsworth Till in the Chicago area has been reported to be up to 60 feet thick.

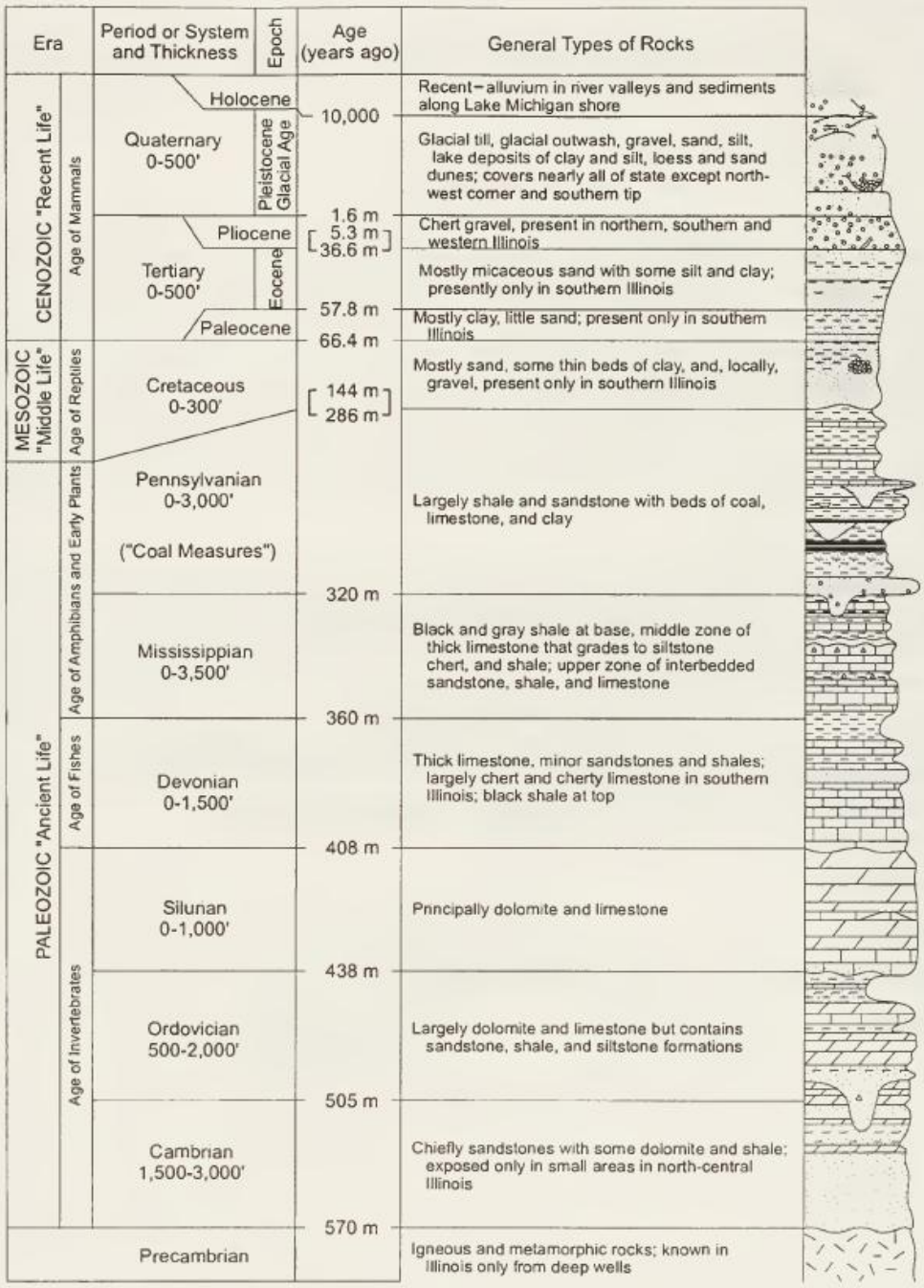
Bedrock Geology

18. The uppermost bedrock unit in the Chicago area is the Silurian Niagaran series. The Niagaran series consists of the Racine, Waukesha, and Joliet dolomites. The youngest of the Niagaran series deposits, the Racine dolomite, is a variable unit. The Racine consists of pure, gray, massive, vuggy dolomite in large reefs, and argillaceous, silty, fine-grained, thin-bedded, grayish-brown, dolomite in the inner-reef area. The Racine dolomite is about 300 ft. thick along the eastern edge of the Chicago area.

19. No major or significant faults have been delineated in the Chicago area. The closest appreciable major fault is the Sandwich Fault Zone, an inactive fault, approximately 40 miles southwest of Chicago, near Joliet. Intense faulting is also associated with the Des Plaines Disturbance, a roughly circular area approximately 5.5 miles in diameter. The Des Plaines Disturbance is located approximately 15 miles northwest of the project area.

20. The Chicago area is located within a zone of the central mid-continent that is tectonically stable and seismically relatively quiet, i.e. seismic zone 1. The closest known earthquake sources of significance are the New Madrid Seismic Zone in southeastern Missouri and the Wabash Fault System in southern Illinois.

21. In general, bedrock is found between EL 500-550 ft, and approximately 50-100 ft below overburden materials. It is not expected that bedrock will be encountered during dredging nor have an impact on dredge material placement.



Generalized geologic column showing succession of rocks in Illinois. The sediments of Illinois Beach State Park and Zion beach-ridge plain are of the Holocene Epoch (less than 10,000 years in age).

Figure D - 4: Generalized Geologic Column

III. SHORELINE HISTORY

22. The physiography or geomorphology of the Illinois-Indiana coastline developed in response to glacial processes that formed the lake margin and, subsequently, coastal processes that modified it by erosion and accretion. Glacial landforms significantly influenced coastal evolution and paleogeography. Prior to 2500 years ago, separate sand spit systems terminated on the eastern and western shores of the lake. During the last 2500 years, the systems coalesced forming the present coastline that continues to be modified mainly by erosion.

23. The 96-mile shoreline of Illinois and Indiana can be divided into three provinces. The northernmost is the Zion beach-ridge plain that extends from the Wisconsin border southward into Illinois as far as the city of North Chicago. This province is 12 miles long, has a maximum width of slightly more than one-half mile and, stratigraphically, contains sediments as thick as 37 feet. The second province, the Lake Border morainal-bluff coast, extends for 15 miles from North Chicago to Winnetka. The shoreline has eroded into terminal moraines of the Lake Border Morainic Complex, producing bluffs that are as high as 100 feet. The bluffs decrease in height to the south. The third province, the Chicago/Calumet lacustrine plain, rims the southern margin of the lake, extending 69 miles from Winnetka, IL to the Indiana-Michigan state line. The relief ranges from low lying areas near lake level to the Indiana Dunes, which are as much as 165 feet high. Fifty-eight percent of all uplands along the Illinois-Indiana coast range from 0-30 feet in height. All of the Zion beach-ridge plain and most of the Chicago/Calumet lacustrine plain are no more than 20 feet above the mean lake level.

24. Offshore from these coastal features, the lake bottom sediment texture and stratigraphy show that much of the lakefloor is a dynamic environment; within about 12 miles of shore, currents induced by storm waves transport fine sand and silt resulting in a patchy, continually changing distribution of lacustrine sediment overlying a till-gravel pavement. Only north of Waukegan, Ill. and east of Michigan City, Ind. does silty sand completely cover the surface of Wadsworth Till, which is composed mostly of silty clay. A nearshore sand wedge extends from north of Waukegan and thins southward to Chicago. South of Lake Forest, the nearshore sand wedge is limited to within 1000 feet of the shoreline.

25. Coastal engineering has altered or influenced changes along nearly all of the 63 miles of the Illinois coast. The only remaining shoreline segments that are free of any shore protection structures are a three mile reach in the South Unit of Illinois Beach State Park and adjoining shore to the south as well as a few isolated locations along the bluff coast. The earliest detailed mapping of coastal topography, shoreline position and nearshore bathymetry along the entire Illinois coast was done between 1871 and 1873 by the U.S. Lake Survey. These topographic/bathymetric surveys provide a valuable baseline for all subsequent historical shoreline change along the Illinois coast. A longer record of shoreline change is documented by surveys of the U.S. Army Engineers near the mouth of the Chicago River. Detailed shoreline mapping at the river mouth began in 1830 related to planning for a navigable channel to link the river and Lake Michigan (Larson 1980).

26. Sand has been diverted and trapped by harbors and lakefills along the Illinois and Indiana shore, depleting the supply of littoral sand for longshore drift. Most sand on the western side of the lake is concentrated along an 8.5 mile stretch of coast north of Waukegan Harbor but much less is present in all the remaining profiles surveyed as far south as Evanston, Ill. Comparisons of sand thickness in several areas south of Waukegan reveal that from 1975 to 1991 sand has been greatly depleted. Though several meters of sand are present in some areas of the bottom in Indiana Shoals, net erosion of the lake floor has taken place there over the last 20 years. West of Michigan City, the nearshore sand wedge is thin or absent. Thus, erosion or non-deposition has been taking place exposing the underlying till or gravel-boulder deposits, and in some places the underlying shale or limestone.

27. North Point Marina is a state-owned and operated, 1500-slip marina on the Lake Michigan shore just south of the Illinois-Wisconsin state line. The marina was constructed in 1987-1989. It is built along a shoreline that has the most severe erosion recorded along the Illinois coast. Shoreline recession has occurred at a long-term average rate of about 10 feet per year (Jennings 1990; Chrzastowski and Frankie 2000). Prior to the State of Illinois acquiring this land in the 1970s, private residential property occupied the area (Bannon-Nilles 2003). The persistent erosion contributed to the abandonment of the residential land use. The erosion relates to the long-term coastal dynamics and southward migration of the Zion beach-ridge plain that was previously discussed. Erosion has been halted along the marina footprint, but the erosional trends continue to the south (downdrift) of the marina along the North Unit of Illinois Beach State Park.

28. Contrasting with the net erosion at the north end of the Zion beach-ridge plain near North Point Marina is the net accretion near the south end of the sand plain in the vicinity of Waukegan Harbor. The U.S. Army Corps of Engineers became involved in constructing a harbor at Waukegan in 1852 and completed a harbor project in the 1880s. The present harbor footprint results from expansion and reconstruction that occurred between 1902 and 1906 and additional improvements built between 1930 and 1932 (Bottin 1988). In 1984 the municipal Waukegan Marina was constructed by on the south side of the original harbor complex.

29. The entrapment of littoral sand against the north jetty and harbor complex has resulted in approximately 420 acres of accreted land that extends as far north as the South Unit of Illinois Beach State Park. There is also a continuing migration of lake-bottom sand to the harbor approach and entrance area. This requires periodic harbor-entrance dredging by the Corps of Engineers.

30. Although the entrapment of sand against the Waukegan Harbor complex is what would be anticipated on the updrift side of such a jetty and breakwater system, this sand accumulation is a special case. As discussed in the section on coastal morphology, the Zion beach-ridge plain is a migratory sand body and is translating southward with time. This southward migration would eventually cause sand accretion and new land in the Waukegan Harbor vicinity even if the harbor structures were not built. However, structures have altered the accretion patterns (Chrzastowski and Trask 1995).

IV. SHORELINE PROCESSES

31. Closer to shore, a nearshore ice complex (NIC) develops and decays repeatedly along the coast of southern lake Michigan between December and March acting as an ephemeral sea wall causing cut and fill along its lakeward margin. Sediment, entrained in the ice as it forms is rafted along the shore and, to a lesser extent, offshore in amounts similar to those supplied by erosion of the northern Illinois bluffs. Factors that impact the transport of littoral sediment by ice include: 1) the multiple break-up and refreezing of a NIC during a single winter; 2) littoral sand, suspended in water nearshore by anchor ice, is formed into the NIC by waves; 3) after sediment is entrained in ice, long range transport is possible; 4) wave energy, rather than melting, breaks up the NIC releasing sand-laden ice to longshore and offshore ice rafting; and 5) jetties and promontories enhance sediment loss to deep water by deflecting ice streams offshore. In short, ice does not protect the coast from erosion.

32. Efforts to quantify and balance the sediment budget for the southern Lake Michigan basin have been largely successful. Sediment sources are bluffs, rivers, aerosols, and basin import. Sediment sinks include the lake basin, basin export, and nearshore sand, beaches, and dunes. During the last 100 years, the period when historical measurements are available, the primary source of sediment is bluff erosion and the primary sink is deposition in the deep lake basin. The budget nearly balances at 3 million tons per year. About half the sand derived from bluff erosion is deposited in deep water. The other half appears to be deposited nearshore, and on beaches and dunes. For periods farther back in time the sediment sinks can be estimated fairly well but the sources are more difficult to evaluate although bluff erosion was probably the dominant source.

33. Additional information on the specifics of shoreline processes and history pertaining to this project may be found in Appendix A of this report.

V. GENERAL SEDIMENT CHARACTERISTICS

34. The surficial sediments of the Zion beach-ridge plain consist of a broad range of materials that include organic-rich sand, silt, and clay in the marsh deposits of the swales, well-sorted medium sands in the dunes, and localized deposits of concentrated coarse sand, pebbles, and cobbles along the beach. The differences in surficial sediments reflect the differences in transport and sorting by either waves or wind. In the subsurface, the sediments are dominated by those deposited below or at lake level as the beach-ridge plain advanced along the coast. The deepest deposits are fine to medium sands with shell material. These sediments, which generally overlie glacial till, accumulated offshore in water as much as 20 feet deep or more and mark the underwater leading margin of the plain. These are overlain by medium to coarse sand and gravel that accumulated in the nearshore and eventually across the beach. These are deposits laid down in shallower water, where the wave energy was greater, and represent the advancement of the nearshore and subaerial parts of the plain along the coast. The subsurface, vertical sequence of offshore, nearshore, and beach deposits mimics the surficial lateral succession of deposits one encounters in traversing from the beach to the offshore area across the lake bottom.

35. The pebbles and cobbles that are distributed across the beach and shallow nearshore are noteworthy for their interesting shapes and the variety of rock types represented. The pebbles and cobbles are well rounded, in part due to their transport by wave processes along the coast. However, as discussed in the Geologic Evolution section, the entire suite of particles found along the beach began as deposits in a glacier-fed river, and much of the rounding of these pebbles and cobbles would have occurred during this river transport. The composition of these pebbles and cobbles represents the variety of rock types that occur in northern Wisconsin, northern Michigan, and southern Ontario, Canada. They were removed from these areas and transported into the Lake Michigan region by a lobe of the continental ice sheet that spread across the Great Lakes region during the last glacial episode of the Great Ice Age.

36. Recent sediment and elutriate sampling indicates that the material is good quality sand, with generally low levels of fines and nutrients. The results of past sampling events show no level of contamination that would cause environmental impacts related to water quality. The historical and current data show that the sediment and elutriate results have been consistent over time.

Illinois Beach State Park Sediment Samples

37. Sediment grab samples are collected at the IBSP reference site north of the North Point Marina in association with the Harbor sampling. The intent is to obtain sediment samples that are representative of the general area where disposal will occur, but to avoid sampling disposed dredged material from a previous dredging event. Dredging sediment samples results and background beach sample results are shown below in Table D - 1.

Table D - 1: Sediment Grain Size Analysis

	Dredging Sediment			Background Beach Sediment		
Year	1	2	3	1	2	3
2008	0.73	0.57	0.53	1.16	0.05	0.58
2009	16	2.8	3.1	1.1	1.1	1.2
2010	25	33	30	25	24	23
2012	6.26	1.38	2.66	0.2	0.4	0.3

*Grain size analysis indicates % particles smaller than #230 sieve

38. Grain size analysis indicates that the sediment in both locations is primarily sand with low fines content. Although the sediment from both locations is primarily sand, the Approach Channel sediment generally has a slightly higher fines content. These results further support the use of a shallow water near shore area for placement of the sediment, rather than placement on the beach.

39. Because this sediment is of good quality, it is recommended that the material be placed in Lake Michigan. The best method for this sediment is placement in the littoral zone in 18' of water. Beach placement could be an option if sufficient beach area were available, in addition to overcoming other practical limitations. Both of these alternatives would be consistent with the Illinois Coastal Management priorities and the goals of this project, as well as with water quality guidelines. However, water quality monitoring may be needed to show conformance with Lake Michigan water quality standards. Placement of the material in deep water is not appropriate since it would remove sediment from the littoral zone and would work against project and coastal zone management goals.

40. Please refer to *Contaminant Determination for Waukegan Harbor Approach Channel and Advanced Maintenance Area* for additional information regarding sediment characteristics.

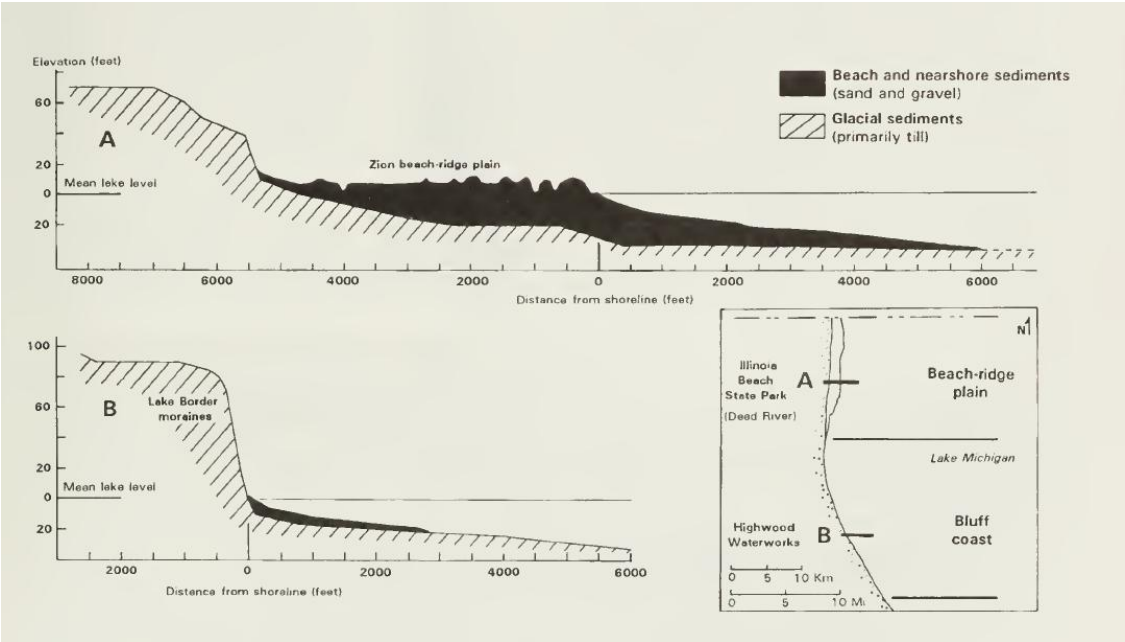


Figure D - 5: Cross Sections of beach and near shore sediments along the Illinois coast comparing the thickness and breadth of deposits at the Zion beach-ridge plain near Dead River (A) and along the bluff coast at Highwood Waterworks (B) (Source: Chrzastowski and Trask 1995)

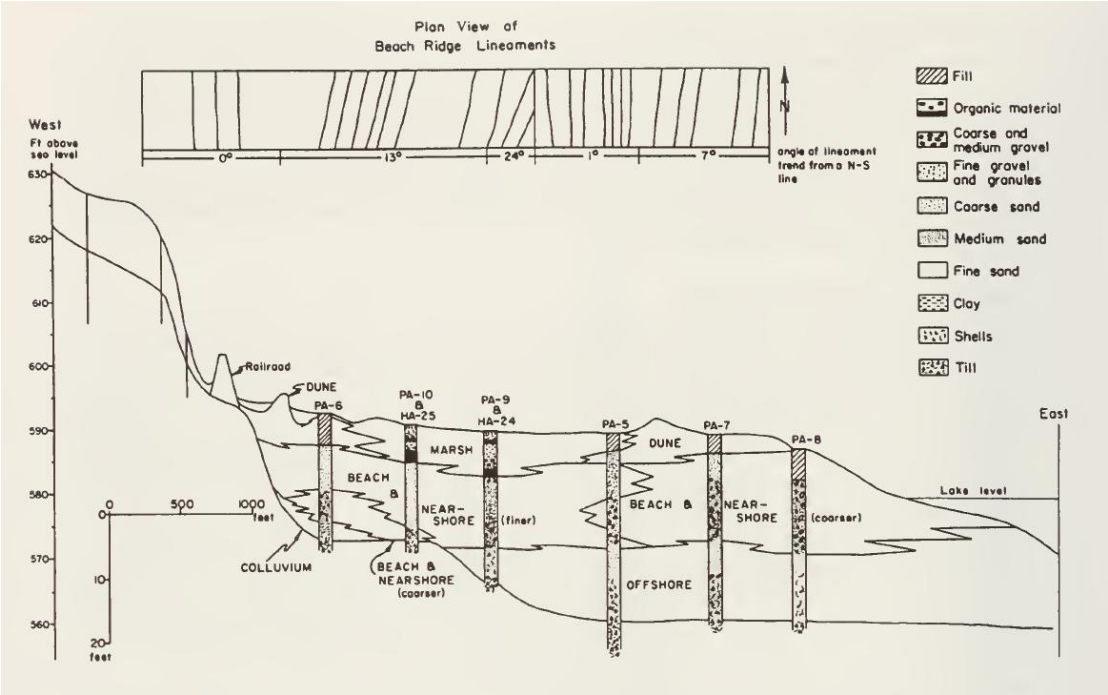


Figure D - 6: Cross section subsurface sediments and depositional environments. Compiled from drill holes taken along a west-east line from the state park entrance to the parking lot near the main swimming beach (Source: Hester and Fraser 1973)

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ATTACHMENT D-1 - 2012 Approach Channel Sediment Samples - Ryba Marine Construction Company

INTERRA Engineering • Inspection • Testing

Summary

Project	USACE Sediment Samples
Client	Suburban Laboratories-Hillside, IL
File #	6054

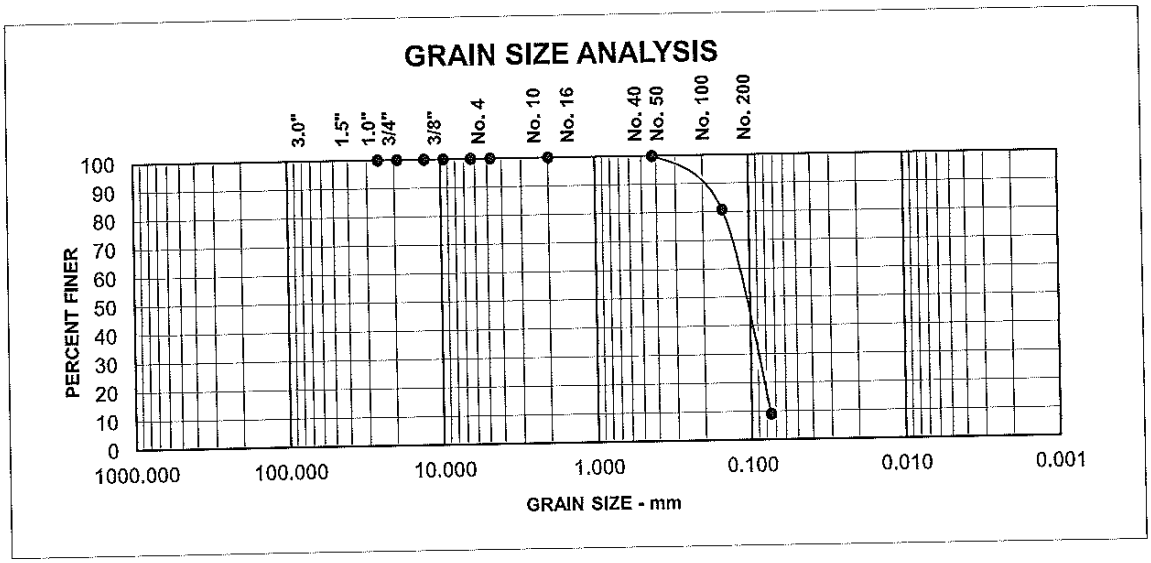
	Sample ID	Atterberg, ASTM D4318	Grain Size ASTM D422,		IEPA,	Standard Proctor ASTM D698	
			Classification	*Percent Fines, Sieve #230*	*Percent Fines, sieve #230*	*Maximum Density, pcf*	*Optimum Moisture, %*
1	1207615-001C	N/A	SP-SM	6.1	6.26	N/A	N/A
2	1207615-002C	N/A	SP	1.0	1.38	N/A	N/A
3	1207615-003C	N/A	SP	2.1	2.66	N/A	N/A

INTERRA

GRAIN SIZE ANALYSIS

Project	USACE Sediment Samples						
Client	Suburban Laboratories, 4140 Litt Dr., Hillside, IL 60162						
File No.	6054	Sample #	1207615-001C	Date Tested	7/16/2012	Tested by:	PP
						Qc by:	KDK

Date Sample Received:	7/13/12
Sample Location:	
Sample Description:	Brown & Gray poorly graded sand with silt (Sediment)



% + 3"	% Gravel	% Sand	% Fines
0.0	0.0	93.8	6.1

Sieve Size	Percent Passing
1.5"	100.0
1.0"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
1/4"	100.0
#4	100.0
#10	100.0
#40	99.8
#100	80.7
#200	9.1
#230	6.1

D85 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	Cc	Cu
0.17	0.12	0.09	0.075	0.9	1.6

Soil Classification	SP-SM
Soil Description	Poorly graded sand with silt
System	USCS

Remarks:

Test ID	49012

www.interra.co

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IEPA

Project	USACE Sediment Samples						
Client	Suburban Laboratories, 4140 Litt Dr., Hillside, IL 60162						
File No.	6054	**Sample #**	1207615-001C	**Date Tested**	7/17/2012	**Tested By**	PP
						Qc By	KDK

Date Sample Received	7/13/2012
Sample Location	
Sample Description	Brown & Gray poorly graded sand with silt (Sediment)

Control Sieve No. :	230 (63-micron sieve)	
Pan No. :	CC-1	
Pan Weight :	172.28	gm
Pan + Dry Sample Weight Before Wash :	222.28	gm
Pan + Dry Sample Weight After Wash :	219.15	gm
Percent Fines :	**6.26**	**%**

Remarks

www.interra.co

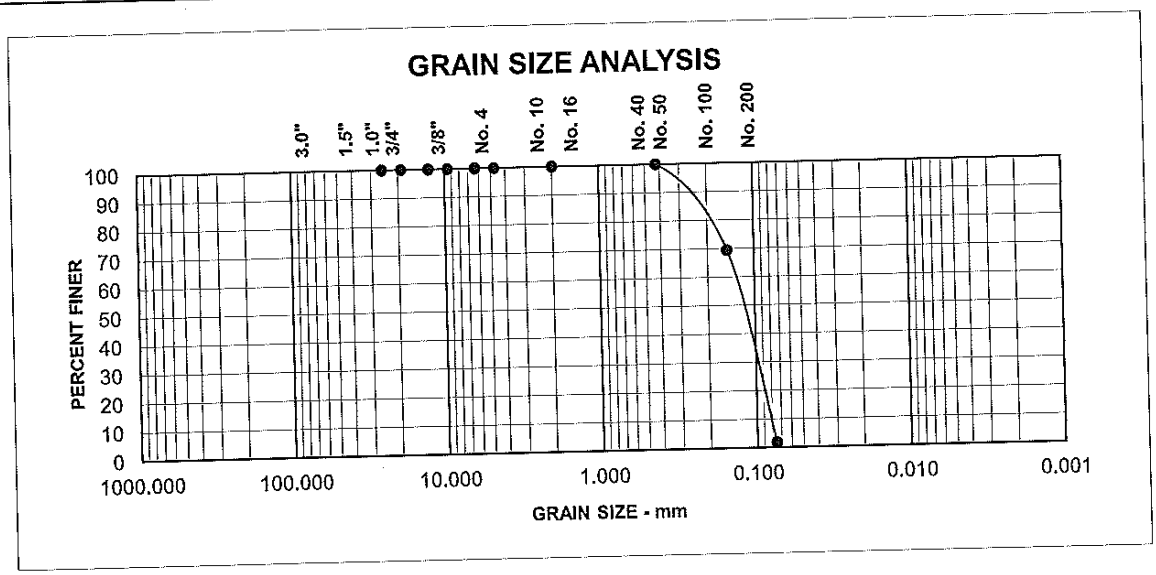
Test ID	49013

INTERRA

GRAIN SIZE ANALYSIS

Project	USACE Sediment Samples						
Client	Suburban Laboratories, 4140 Litt Dr., Hillside, IL 60162						
File No.	6054	Sample #	1207615-002C	Date Tested	7/16/2012	Tested by:	PP
						Qc by:	KDK

Date Sample Received:	7/13/12
Sample Location:	
Sample Description:	Brown & Gray poorly graded sand (Sediment)



% + 3"	% Gravel	% Sand	% Fines
0.0	0.0	99.0	1.0

Sieve Size	Percent Passing
1.5"	100.0
1.0"	100.0
3/4"	100.0
1/2"	100.0
3/8"	100.0
1/4"	100.0
#4	100.0
#10	100.0
#40	99.9
#100	69.4
#200	1.9
#230	1.0

D85 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	Cc	Cu
0.21	0.14	0.096	0.08	0.8	1.8

Soil Classification	SP
Soil Description	Poorly graded sand
System	USCS

Remarks:

Test ID	49014

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Project	USACE Sediment Samples						
Client	Suburban Laboratories, 4140 Litt Dr., Hillside, IL 60162						
File No.	6054	**Sample #**	1207615-002C	**Date Tested**	7/17/2012	**Tested By**	PP
						Qc By	KDK

Date Sample Received	7/13/2012
Sample Location	
Sample Description	Brown & Gray poorly graded sand (Sediment)

Control Sieve No. :	230 (63-micron sieve)	
Pan No. :	CC-3	
Pan Weight :	156.28	gm
Pan + Dry Sample Weight Before Wash :	206.28	gm
Pan + Dry Sample Weight After Wash :	205.59	gm
Percent Fines :	**1.38**	**%**

Remarks

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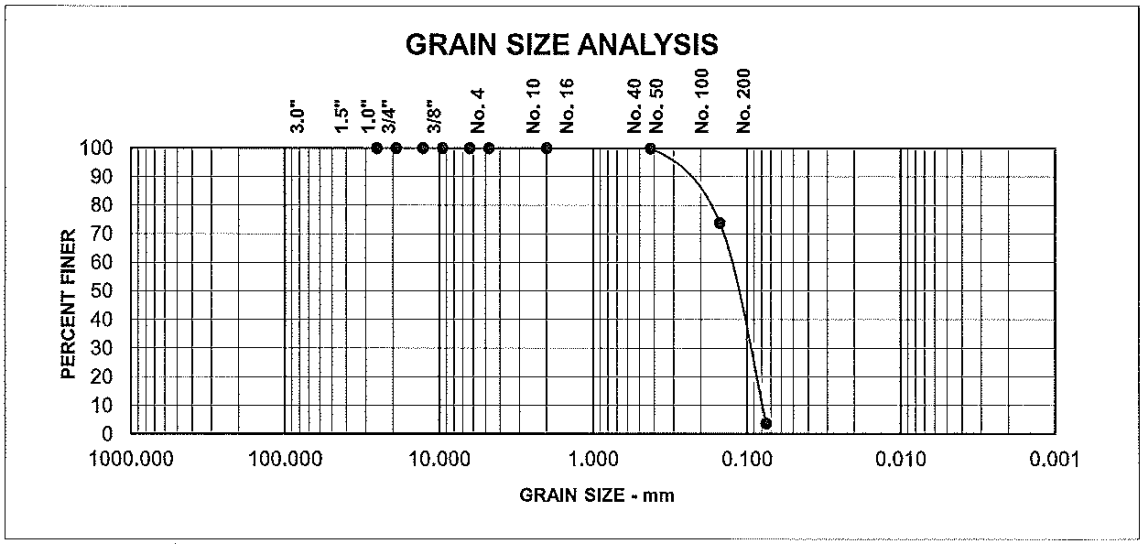
Test ID	49015

INTERRA	GRAIN SIZE ANALYSIS

Project	USACE Sediment Samples						
Client	Suburban Laboratories, 4140 Litt Dr., Hillside, IL 60162						
File No.	6054	**Sample #**	1207615-003C	**Date Tested**	7/16/2012	**Tested by:**	PP
						Qc by:	KDK

Date Sample Received:	7/13/12
Sample Location:	
Sample Description:	Brown & Gray poorly graded sand (Sediment)



% + 3"	% Gravel	% Sand	% Fines	
0.0	0.1	97.8	2.1	

Sieve Size	Percent Passing	D85 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	Cc	Cu
1.5"	100.0	0.19	0.13	0.093	0.08	0.8	1.6
1.0"	100.0						
3/4"	100.0						
1/2"	100.0						
3/8"	100.0						
1/4"	100.0						
#4	100.0						
#10	99.9						
#40	99.9						
#100	73.8						
#200	3.7						
#230	2.1						

Soil Classification	SP
Soil Description	Poorly graded sand
System	USCS

Remarks:

www.interra.co

Test ID	49016

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IEPA

Project	USACE Sediment Samples						
Client	Suburban Laboratories, 4140 Litt Dr., Hillside, IL 60162						
File No.	6054	**Sample #**	1207615-003C	**Date Tested**	7/17/2012	**Tested By**	PP
						Qc By	KDK

Date Sample Received	7/13/2012
Sample Location	
Sample Description	Brown & Gray poorly graded sand (Sediment)

Control Sieve No. : 230 (63-micron sieve)

Pan No. :	CC-2	
Pan Weight :	148.19	gm
Pan + Dry Sample Weight Before Wash :	198.19	gm
Pan + Dry Sample Weight After Wash :	196.86	gm
Percent Fines :	**2.66**	**%**

Remarks

www.interra.co

Test ID	49017

SUBURBAN LABORATORIES, Inc.

4140 Litt Drive Hillside, IL 60162 Tel. 708.544.3260 Fax: 708.544.8587 Toll Free: 800.783.LABS www.suburbanlabs.com

CHAIN OF CUSTODY RECORD

Electronic Version

Company Name: Ryba Marine
Company Address: 629 N. Main Street / PO Box 265
City: Cheboygan State: MI Zip: 49721
Phone: Fax: ☐ Fax Report
Email Address: wmoon@rybamarine.com ☑ Email Report
Project ID / Location: Waukegan Harbor Dredging FY11/FY12
Project Manager (Report to): Wayne Moon
Sample Collector(s): PAT IRELAN – [illegible] 7/12/12

TURNAROUND TIME REQUESTED
☑ Normal ☐ RUSH* *Additional Rush Charges Approved.
*Date & Time Needed:
Normal TAT is 5-7 work days for most work. Rush work must be pre-approved and additional charges apply.
Specify Regulatory Program: (Required) ☐ None/Info only
☐ LUST ☐ SRP ☐ SDWA
☐ 503 Sludge ☐ NPDES ☐ MWRDGC
☐ Disposal ☑ Other *Please specify in comment section below.

ANALYSIS & METHOD REQUESTED
Enter an "X" in box below for request

Page 1 of 1
PO No.
Shipping Method: SLI
QC Reporting Level ☐ 1 ☑ 2 ☐ 3

LAB USE ONLY
SLI Order No. 12071615
Sample containers supplied by customer? ☐ Yes
Temperature of Received Samples 2 °C
Samples received within 24 hours of collection? ☐ Yes

	SAMPLE IDENTIFICATION (Please use 1 line per container type)	COLLECTION DATE	COLLECTION TIME	MATRIX	GRAB/ COMP.	CONTAINERS Qty	CONTAINERS SIZE & TYPE	PRESERVATIVE	PCBs	Asbestos (PLM & TEM)	Grain Size/Particle Size	Supernatant Prep	R	Condition	Split	LAB #
1	After Operations Sediment #1 (K)	7/12/11	11:45 am	Sediment	G	5	1LG	none	X	X	X	X				-001A/B/C/D
2	After Operations Sediment #2 (V)	↓	12:20 pm	Sediment	G	5	1LG	none	X	X	X	X				-002A/B/C/D
3	After Operations Sediment #3 (L)	↓	12:45 pm	Sediment	G	5	1LG	none	X	X	X	X				-003A/B/C/D
4																
5																
6																
7																
8																
9																
10																
11																
12																

MATRIX: Drinking Water (DW), Soil (S), Waste Water (WW), Surface Water(SW), Ground Water (GW), Solid Waste (WA), Sludge (U), Wipe (P) CONTAINER: 2oz, 4oz, 8oz, 40ml Vial, 500ml, Liter (L), Tube, Glass (G), Plastic (P) PRESERVATIVE: H_2SO_4, HCl, HNO_3, Methanol (MeOH) NaOH, Sodium Bisulfate (NaB), NaThio

COMMENTS & SPECIAL INSTRUCTIONS:

* Chicago District USACE - Waukegan Harbor Approach Channel Dredging project 2010

CONDITION CODES
1. Improper/damaged container/cap
2. Improper preservation
3. Insufficient sample volume
4. Headspace/air bubbles for VOCs
5. Received past holding time
6. Received frozen
7. Label conflicts with COC

1. Relinquished By	Date	2. Relinquished By	Date	3. Relinquished By	Date	4. Relinquished By	Date
	7/12/12						
Received By ☒ Ice	Time 3:25 pm	Received By ☐ Ice	Time	Received By ☐ Ice	Time	Received By ☐ Ice	Time

Submission of samples subject to Terms and Conditions on back. Rev. 2/01/05 Please fill out this form completely, print, sign & submit with samples. Keep a copy for your records.

FIELD LOG

Suburban Laboratories, Inc.
4140 Litt Drive
Hillside, IL 60162-1183
P: (708) 544-3260 F: (708) 544-8587
www.SuburbanLabs.com

Ryba Marine Construction Co.

FY11/FY12
Dredging of Waukegan Harbor Approach Channel
After Operations Sediment Sampling

Suburban Labs Field Sampling Technician(s) - PRINT: Pat Jrelam

Weather and water conditions: Sun / Cloudy warm

Eutech Inst. Oakton Field pH Meter, pHTestr 30
Serial No.: –

	K After Operations Sediment 1	V After Operations Sediment 2	L After Operations Sediment 3	Additional Comments:
Sampling Technique:	grab	grab	grab	
GPS coordinate (Lat./Long.) of sample collection:[1]	E 1126352.981 N 2075010.379	E 1126060.771 N 2075032.193	E 1126055.839 N 2074996.051	
GPS coordinate (state plane) of sample collection:[1]	NAD 83	NAD 83	NAD 83	
Date & Time of collection:	7/12/12 11:45 Am	7/12/12 12:20 pm	7/12/12 12 45 pm	
Sample appearance: (clear, tinted, dark, etc..)	Dark (Sand) →	→	→	
pH & Time of reading:				
Temperature (degrees C):				
Comments:	2 scoops	5 scoops	5 scoops	

See also chain of custody form for bottles and preservatives

Version 0 06/16/2010

SIGNATURES:

SLI Field Tech 1: [signature]

SLI Field Tech 2: _____

After Operations Sediment
07/12/12