

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

**APPENDIX E – CONTAMINANT DETERMINATION**



**September 2013**



**DEPARTMENT OF THE ARMY  
CHICAGO DISTRICT, CORPS OF ENGINEERS  
231 SOUTH LASALLE STREET  
CHICAGO, ILLINOIS 60604**

CELRC-TS-DH

August 2, 2013

MEMORANDUM FOR CELRC-PM-PL-F (Jarzemsky)

**SUBJECT: Contaminant Determination for Waukegan Harbor Approach Channel and Advanced Maintenance Area, Illinois Beach State Park Section 204 Project**

1. Enclosed is the Contaminant Determination for Waukegan Harbor Approach Channel and Advanced Maintenance Area, Illinois Beach State Park Section 204 Project. The investigation was conducted during the planning phase of the project and is based on previous sampling events.
2. Results of the Contaminant Determination suggest that the best placement method for this sediment is in the littoral zone, in approximately 18' of water.
3. If there are any questions regarding this investigation, please contact Margaret Rauwerdink at (312) 846-5502.

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Enclosure

Contaminant Determination for  
Waukegan Harbor Approach Channel and Advanced Maintenance Area

Illinois Beach State Park  
Section 204 Project

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July 2013

Illinois Beach State Park Section 204

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## 1. Introduction

The following document is a contaminant determination (CD) prepared by the U.S. Army Corps of Engineers (USACE) Chicago District for the maintenance and advanced maintenance dredging of Waukegan Harbor Approach Channel and Advanced Maintenance Area. The Chicago District is investigating opportunities for regional sediment management along the shore of Lake Michigan. Currently the shoreline near the Wisconsin state line is eroded, while further south near Waukegan Harbor sediment is shoaling and impedes navigation. The proposed project will include dredging sediment from Waukegan Harbor for disposal near Illinois Beach State Park.

This CD covers the recent sediment collection, analysis, and results for Waukegan Harbor Approach Channel and Advanced Maintenance Area. These sampling events were performed in accordance with the *Great Lakes Dredged Material Testing and Evaluation Manual* (USEPA and USACE 1998b) and the *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.* (USEPA and USACE 1998a).

## 2. Waukegan Harbor

Waukegan Harbor is located in Northeast Illinois, approximately 40 miles north of Chicago (Figure 1). Waukegan Harbor is a man-made harbor constructed in 1880, and has been expanded and modified over the years. The harbor does not include any natural tributary outlets. The current configuration has been in place for approximately 10 years. Waukegan Harbor is divided into various units; this CD concerns the Approach Channel and Advanced Maintenance Area (Figure 2). The Approach Channel is on the lakeward end of the harbor, and is bounded to the north by the Advanced Maintenance Area. As documented by the Illinois Coastal Management Program, the net littoral drift in this area is from the north to the south (IL DNR 2001). The shoaling in the Approach Channel and Advanced Maintenance Area originates from the same source and is homogeneous.

**Figure 1: Location of Waukegan Harbor**



**Figure 2: Units of Waukegan Harbor**



### **3. Maintenance Dredging**

The Chicago District is responsible for all maintenance dredging within the federal navigation channel of Waukegan Harbor. The Approach Channel and Advanced Maintenance Area, which are located outside of the harbor confines, have not been subject to contaminant migration and are dredged on a regular basis. The sediment in the Approach Channel is primarily littoral drift sand from the Northern Illinois cell littoral drift that moves material southward from the southern Wisconsin lakeshore at Kenosha and migrates around the northern breakwater at Waukegan Harbor (Chrastowski, Thompson, & Trask, 1994).

The Advanced Maintenance Area is heavily shoaled and the shoaling extends to the Approach Channel. Sand bars encroaching on the channel cause dangerous conditions for large freight vessels. Nearly annual maintenance is required to prevent shoaling from blocking the federal channel and harbor entrance. The Approach Channel and Advanced Maintenance Area have been dredged nearly annually since 1995. The amount of dredging is dependent on available funding; however there is a large backlog of shoaled material that could be removed. Recent dredging events have been on the order of 50,000 – 75,000 cubic yards of material. However many more cubic yards of material are accumulated in the Advanced Maintenance Area and could be dredged to protect the Approach Channel.

The Waukegan Harbor Approach Channel maintenance dredging currently operates under permit 2005-LM-2830 from the Illinois Environmental Protection Agency (IEPA) and permit LM2005003 from Illinois Department of Natural Resources (IL DNR). The permits were received in 2005, and modified in 2008 and 2009. The existing permits expire in 2014, however new permits will be applied for in order to continue required maintenance of the federal channel.

### **4. Local Land Use and Potential Contaminant Sources**

Waukegan Harbor is currently used for both recreational and industrial uses. Past land uses around the Harbor have been mostly industrial. Since the late 1800's, documented industry

within a mile of Waukegan Harbor includes steel processing; paint and dye industry; foundry work; coking operation; manufacture of construction materials including wallboard, insulation and concrete products; wastewater and water treatment; and marine motor and vessel construction. Past activities and discharges from industry into the Harbor led to contamination of the inner harbor sediment, and the adjacent area and the inner harbor were placed on the National Priority List in 1983. A large clean-up operation in the 1990s removed the most heavily contaminated sediment. A subsequent USEPA dredging project in 2012 – 2013 has removed residual low level PCB contamination and once the work is complete the inner harbor will be considered remediated. The outer harbor material was not impacted by PCBs and was not included in the Superfund project area. The outer harbor material is clean but fine grained, and it is considered suitable for unconfined upland use. The outer harbor is not part of the Approach Channel maintenance dredging. See Figure 2 for the units of Waukegan Harbor.

The Approach Channel and Advanced Maintenance Area are outside the harbor and do not receive direct drainage from the harbor properties. The project area was not impacted by PCB contamination, and repeated sampling (as further discussed in Section 5 below) has not indicated the presence of significant PCB concentrations.

Further north along the shoreline, and therefore upstream along the littoral drift pattern, the Johns Mannville site manufactured asbestos containing building materials. At one time, it was considered possible that materials from this site had entered Lake Michigan and contaminated the littoral drift material. This site was also suggested to be a source of asbestos containing building materials that have periodically been found along Illinois Beach State Park. Due to these concerns, asbestos testing has been completed (see Section 5 below). No asbestos has been found in the Advanced Maintenance Area or Approach Channel, and the Johns Mannville site, the potential source of material, has been remediated and no longer represents a potential source.

There are no new potential sources of pollution such as new industry, and past sampling events have not uncovered any notable changes in sediment quality. The main source of sediment for the Approach Channel and Advanced Maintenance Area is still littoral drift material.

## 5. Waukegan Harbor Sediment Sampling

In accordance with permit conditions, sediment and water samples are collected in advance of maintenance dredging events. The purpose of this sampling is to obtain and characterize material that is representative of the dredge area. The sampling results emphasize the contaminants that historically had potential to be present in the Approach Channel and Advance Maintenance Area sediment. Table 1 gives a summary of the sampling that has occurred for the Approach Channel.

**Table 1: Summary of Approach Channel Sediment Results, 1997-2012**

Sample Number	Sample Date	PCB Concentration (mg/kg)	Asbestos Concentration <sup>1</sup> (%)	Grain Size (% fines) <sup>2</sup>
WH-SED-0712-1	07/12/12	<0.0214	ND	6.3
WH-SED-0712-2		<0.0214	ND	1.4
WH-SED-0712-3		0.0163	ND	2.7
WH-SED-0810-1	08/10/10	<0.00271	ND	25

Sample Number	Sample Date	PCB Concentration (mg/kg)	Asbestos Concentration <sup>1</sup> (%)	Grain Size (% fines) <sup>2</sup>
WH-SED-0810-2		<0.00271	ND	33
WH-SED-0810-3		<0.00271	ND	30
WH-SED-1027-1	10/27/09	<0.0216	ND	16
WH-SED-1027-2		<0.0216	ND	2.8
WH-SED-1027-3		<0.0216	ND	3.1
WAM-1008-001	10/08/08	0.08 (PCB-1248)	ND	0.73
WAM-1008-002		0.049 (PCB 1248)	ND	0.57
WAM-1008-003		<0.017	ND	0.53
WAM-0905-001	09/05/07	<0.0269	ND	1.4
WAM-0905-002		<0.0264	ND	0.5
WAM-0905-002		<0.0289	ND	4.2
WAM-1005-001	10/27/05	<0.0324	ND	4.5
WAM-1005-002		<0.0340	ND	6.5
WAM-1005-003		<0.0411	ND	3
WAM-0804-001	08/16/04	<0.0336	ND	1.1
WAM-0804-002		<0.0313	ND	3.9
WAM-0804-003		<0.0310	ND	1.2
WUD-1003-001	10/27/03	<0.0336	ND	0.4
WAM-1003-001		<0.0336	ND	6.4
WAM-1003-002		<0.0336	ND	4.0
WAM-1003-003		<0.0336	ND	0.8
WAM-1003-COMP		-- <sup>3</sup>	ND	--
WUD-1002-001	10/10/02	<0.0388	ND	1.7
WAM-1002-001		<0.0388	ND	0.8
WAM-1002-002		<0.0388	ND	17.3
WAM-1002-003		<0.0388	ND	8
WAM-1002-COMP		--	ND	--
WUD-1001-001	10/23/01	< 0.025	ND	5.8
WAM-1001-001		< 0.025	ND	5.2
WAM-1001-002		< 0.025	ND	4.9
WAM-1001-003		< 0.025	ND	17.6
WAM-1001-COMP		--	ND	--
WAM-1000-001	10/17/00	< 0.025	ND	3.7
WAM-1000-002		< 0.025	ND	3.6
WAM-1000-003		< 0.025	ND	2.8
WAM-1000-004		< 0.025	ND	3.4
WAM-1000-005		< 0.025	ND	3.2
WAM-1000-006		< 0.025	ND	3.9
WAM-1000-COMP		--	Trace	--

Sample Number	Sample Date	PCB Concentration (mg/kg)	Asbestos Concentration <sup>1</sup> (%)	Grain Size (% fines) <sup>2</sup>
WAUK-AM-1	9/23/99	< 0.025	ND	1.4
WAUK-AM-2		< 0.025	Trace	6.0
WAUK-AM-3		< 0.025	ND	5.5
WAUK-AM-COMP		--	ND	--
WAM-1198-001	11/24/98	< 0.05	ND	1.2
WAM-1198-002		< 0.05	ND	0.6
WAM-1198-003		< 0.05	ND	0.6
WAM-1198-COMP		--	ND	--
WOH-1297-001	12/17/97	0.074	ND	0.8
WOH-1297-002		< 0.05	ND	0.3
WOH-1297-003		0.08	ND	1.0

**Notes:**

<sup>1</sup> 2005 - 2012 asbestos analyses were performed by Polarized Light Microscopy (PLM) and Transmission Electron Microscopy (TEM). All previous asbestos analyses were performed by Polarized Light Microscopy (PLM) except for the six composites, which were performed using Transmission Electron Microscopy (TEM)

<sup>2</sup> “% fines” indicates the percentage of particles passing through a #230 sieve

<sup>3</sup> “--” indicates that the sample was not analyzed for the parameter

### 5.1. Grain Size Analysis

According to Title 35 of the Illinois Administrative Code (Subtitle C, Chapter 2, Part 395), a particle size analysis is required to evaluate the potential for water pollution due to the discharge of dredge and fill. Table 1 contains recent grain size results for sediment collected from the Advance Maintenance Area and Approach Channel between 1997 and 2012. Grain size analysis indicates that the sediment is primarily sand with low fines content. In general, materials with low fines content tend to have low anthropogenic contaminants content, since those compounds tend to adhere to fine materials.

### 5.2. PCB Analysis

As part of a Tier I analysis performed by USACE in 1995, data were collected from past sampling events in the Advance Maintenance Area and Approach Channel and a mean concentration for PCBs was computed. In determining the mean concentration, non-detect data was assumed to be equal to the reporting limit. The average total PCB concentration of the historic samples, which includes samples from 1985-1995, was calculated to be 0.2 mg/kg, with individual values as high as 0.6 mg/kg total PCBs (USACE 1995). Table 1 contains more recent PCB testing results for sediment collected from the Advance Maintenance Area and Approach Channel between 1997 and 2012. Almost all sediment samples have been non-detect for each PCB aroclor except an occasional result below the calculated historic mean of 0.2 mg/kg and well below the TSCA-regulated level of 50 mg/kg for PCB-contaminated material. PCBs have not been found in any appreciable quantity.

### 5.3. Asbestos Analysis

Table 1 contains recent asbestos testing results for sediment collected from the Advance Maintenance Area and Approach Channel between 1997 and 2012. Asbestos has not been found in any appreciable quantity. Results from the sampling events in 1997-1998 and 2001-2012 have shown no evidence of asbestos. One sample from both the 1999 and 2000 sessions detected a trace amount of asbestos, but not at a concentration high enough to classify it as asbestos containing material (ACM). The sediment samples were analyzed using two asbestos analytical methods: PLM and TEM. The PLM method evaluates the sediment for asbestos containing building material and asbestos fibers/bundles/matrices and has the ability to detect fibers greater than or equal to 5 microns. The TEM method uses a more sophisticated technology that can analyze fibers greater than or equal to 0.5 microns.

Additional asbestos sampling was conducted in 2006 as part of a study funded by the Illinois Attorney General (Asbestos Task Force, 2006). That sampling event included the analysis of 12 core samples from the Harbor for asbestos following the “Superfund elutriator” method. Only trace asbestos was found, and a subsequent risk evaluation found that the risk from upland placement of the material was not significant to human health. Subsequent asbestos investigation at Illinois Beach State Park has documented that the forms of asbestos found at Illinois Beach State Park are not the regulated varieties used in commercial products, and that dry sand beach activities did not result in air levels of asbestos greater than the reference sites used in the study (Agency for Toxic Substances and Disease Registry, 2007).

### 6. Waukegan Harbor Elutriate Data

Dredging sediment from a waterway can generate concern about the release of contaminants to the water column. A supernatant (elutriate) test involves mixing sediment and site water, allowing the particles to settle, and analyzing the supernate for contaminants. Supernate is the liquid above the sediment that has settled out. IEPA has required elutriate analyses for the Approach Channel and Advanced Maintenance Area work, to ensure that even naturally occurring compounds are not found in levels that would cause environmental impacts. Until recently, elutriate samples were not taken on an annual basis, however recently samples have been taken for each dredging event. Elutriate data, with a four hour settling time to represent the time the material is held in the barge prior to placement, is summarized in Table 2.

**Table 2: Recent Elutriate Data from Waukegan Approach Channel**

Parameter <sup>1</sup>	Limits <sup>2</sup>	2008	2009	2010	2012
Sediment % fines (avg)	20%	0.61%	7.3%	29.3%	3.4%
TSS	15 mg/L	82 mg/L	2230 mg/L	1540 mg/L	131 mg/L
TVS	---	69 mg/L	5.09 mg/L	9.14 mg/L	164 g/L
TDS	---	190 mg/L	187 mg/L	185 mg/L	280 mg/L
Total phosphorus (as P)	0.007 mg/L	0.033 mg/L	0.0037 mg/L	<0.005 mg/L	0.16 mg/L
Ammonia-nitrogen (as N)	0.02 mg/L	0.51 mg/L	3.13 mg/L	0.44 mg/L	0.195 mg/L
Sulfate	---	25 mg/L	26 mg/L	28 mg/L	26 mg/L
Chloride	12 mg/L	14 mg/L	14.2 mg/L	18.6 mg/L	9.45 mg/L
Lead (total)	---	0.020 mg/L	0.0094 mg/L	0.029 mg/L	0.00398 mg/L

Parameter <sup>1</sup>	Limits <sup>2</sup>	2008	2009	2010	2012
Zinc (total)	---	0.089 mg/L	0.031 mg/L	0.10 mg/L	0.0131 mg/L
Total PCBs	0.1 µg/L	<0.15 µg/L	<0.02 µg/L	<0.02 µg/L	<0.143 µg/L

<sup>1</sup> Elutriate/supernatant parameters are for a four hour settling time.

<sup>2</sup> Limits are the State of Illinois Lake Michigan Discharge Standards for the sediment placement activities (from IEPA permit 2005-LM-2830)

In general, solids and nutrients tend to be above the water quality standard, but are still low. Metals are very low and PCBs are non-detectable. The use of a mixing zone analysis would suggest that the low levels of solids and nutrients are not an issue for open water placement, particularly in an active littoral or wave zone where the materials will be quickly diluted. During past placement of the sediment, a shallow near shore area has always been chosen for this reason. Monitoring during disposal operations has found no significant impacts to Lake Michigan. No fish mortality or morbidity has been noted, and measured aquatic concentrations are found to be very low or at background concentrations.

### 7. Illinois Beach State Park Sediment Samples

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 3.

**Table 3: Sediment Grain Size Analysis**

Year	Dredging Sediment			Background Beach Sediment		
	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

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.

### 8. Potential Sediment Placement Options

Based on the sediment grain size and chemical quality, it is proposed that the material in the Waukegan Approach Channel and Advanced Maintenance Area is suitable for beach nourishment, placement in the littoral zone, or placement in deep water. These three options are discussed further below.

### **8.1. Beach Placement**

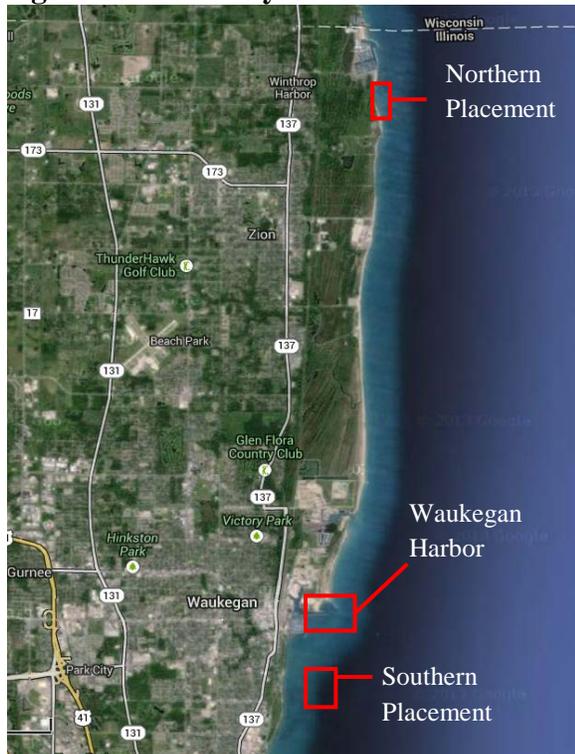
Beach nourishment typically refers to the direct placement of sediment on the beach, below the ordinary high water mark but above the current water level. For practical reasons, sediment is typically placed hydraulically, allowed to drain back to the waterway, and then spread mechanically using conventional earthmoving equipment. To allow this type of placement, some beach area must be available for use. This can be disruptive to seasonal recreation as well as to beach foredune habitat areas if the placement is not controlled. However, the placement of sediment above the water level has the effect of rapidly building the beach. Coarse sand is typically suitable for beach placement since it drains readily and tends to have less unaesthetic properties than fine grained material. The placement of high fine content sand is typically objected to by beach visitors.

The Waukegan Approach Channel and Advanced Maintenance Area sediment would potentially be suitable for this type of placement. The largest factor would be to determine an appropriate placement site along the Illinois Beach State Park shoreline area, since the beach is quite eroded. Sufficient space may not be available. In addition, IBSP is heavily used and the placement of sand on the beach during the dredging season would require the beach to be closed for a several month period. Additionally, the heavy equipment needed for spreading sand may cause damage to the existing bluff areas and habitat adjacent to the beach. For these practical limitations as well as due to the finer nature of the Approach Channel material as compared to IBSP material, direct beach placement is not the preferred placement method.

### **8.2. Littoral Zone Placement**

Placement in the littoral zone has been the disposal method for Waukegan Approach Channel and Advance Maintenance Area 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).

**Figure 3: Previously Used Placement Areas – Approximate Locations**



Littoral or near shore sediment placement can be done using either mechanical or hydraulic equipment. Because the placement sites historically used for the Waukegan Harbor sediment have been farther away, mechanical placement has been used. The limit of the placement is typically in water less than 18' deep. A practical limit to placing the material is that water must be deep enough for a split hull barge to open and close without getting stuck on the placed sand. Advantages to placing the material in the littoral drift zone include sufficient mixing to dilute any trace nutrients or other water quality parameters to acceptable levels, and that waves will move the coarser material inland toward the beach to help combat erosion of the shoreline. Littoral zone placement in water 18' deep is also considered a form of beach nourishment. Because the goal of this project is beach nourishment and due to the characteristics of the Approach Channel material, littoral zone placement is the preferred placement method.

### **8.3. Deep Water Placement**

Open water placement could be used for the Waukegan Harbor sediment, and has been discussed in the past. This option would include placing the material either hydraulically or mechanically farther from shore and outside of the wave zone in deeper water. Sediment placed in this manner generally sinks to the lake floor and is essentially removed from the littoral zone that exists in shallower water. The deep water placement would ensure sufficient mixing for the nutrients so that water quality standards would be met outside the mixing zone. Because this placement option would remove sand from the littoral zone, it has not been considered a favorable alternative in the past by IL DNR. The current Illinois Coastal Zone Program priorities include protecting the undeveloped lands along Illinois Beach State Park. Removing sand from the active littoral zone would potentially increase erosion over time and is contrary to the achievement of this priority and the goal of this project.

## **9. Conclusion**

Sufficient data exist to evaluate the sediment quality of the Waukegan Harbor Approach Channel and Advance Maintenance Area. Land uses in the harbor area have not changed and former contaminated areas in the inner harbor and adjacent properties are being remediated. No other contamination sources appear to exist.

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. Water quality impacts have not been noted in the past. Based on the similarity of current results with historical data, water quality impacts are not anticipated. Dilution of the nutrients during placement in a mixing zone would meet water quality standards outside the mixing zone.

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. The current IEPA permit requires water quality monitoring to be conducted during dredging and placement. 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.

## 10. References

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