SECTION 404(B)(1) EVALUATION:
Chicago Shoreline Storm Damage Reduction Project
Fullerton Theater on the Lake
Chicago, Cook County, Illinois
November 2012

I. Project Description

a. Location

The Fullerton Theater on the Lake Shoreline Protection Project is located approximately 3 miles north of the City of Chicago loop along the Lake Michigan Shoreline. The project limits begin approximately 600 feet north of West Fullerton Parkway and end approximately 750 feet south of same. The project area (MAP) is adjacent to the west shore of Lake Michigan, in the SE ¼, ¼ of Section 28, T40N R14E of the 2nd principal meridian, and is shown on the Chicago Loop (Illinois) USGS 7.5' topographic quadrangle map. The site is surrounded by a highly urbanized area of the city. The project site includes park land and lakefront trails as well as the Theater on the Lake.

b. General Description

As part of the Chicago Shoreline Protection Project, the City of Chicago proposes to stabilize the shoreline in the vicinity of the Fullerton Theater on the Lake. The project is focused on replacing the existing failing shoreline structures to address park degradation from erosion and provide flood protection for Lake Shore Drive.

Chicago's existing shoreline protection structures were built between 1910 and 1931 and generally consisted of wood pile cribs filled with stones in the shape of steps or paved benches. In the 1950s, the wood piles began collapsing, leaving the structures and parkland to erode and wash away. In 1964, the all-time lowest water levels on Lake Michigan, the wood piles became exposed and started rotting, further increasing the erosion process.

The shoreline restoration includes a replacement of the existing failed revetment with a steel and concrete revetment that is designed to manage wave attack. The upland areas will be reshaped and refined to provide for flood control, and for the management of overtopping wave flows safely back to Lake Michigan. Figure 1 illustrates the project location. Figure 2 illustrates the failing condition of the existing revetment structures.

c. Authority and Purpose

The project is officially called the Chicago Shoreline Protection Project (Interim III). Under resolutions adopted by the Committee on Public Works of the U.S. House (dated December 2, 1971 and April 11, 1974), the U.S. Army Corps of Engineers was directed to study shore erosion problems and erosion control measures for the Illinois shore of Lake Michigan.

Section 101(a)(12) of the Water Resources Development Act of 1996 authorized construction of the Chicago Shoreline Project. A project cooperation agreement (PCA) was executed on 17 May

1999, and provided for the non-Federal sponsor (the City of Chicago and the Chicago Park District) to build specific segments of the project.

(a) IN GENERAL.-The Secretary is authorized to plan, design, and construct a shoreline protection project in Chicago, Illinois.

(b) COMPLETE FEASIBILITY REPORT.-In planning the project authorized by subsection (a), the Secretary shall expedite completion of the feasibility report for the project for shoreline protection, Chicago, Illinois, initiated pursuant to section 101(a)(12) *of the Water Resources Development Act 1996 (33 U.S.C. 2330).*

(c) AUTHORIZATION.-

(1) IN GENERAL.-There is authorized to be appropriated $_____ to carry out the activities authorized by this section.

(2) OTHER.-The Secretary is authorized to use funds previously appropriated _____.

d. Proposed Project

1) Proposed Project Description

The shoreline protection works to be constructed at the Fullerton site include a complete replacement of existing failing revetment structures with new concrete and steel revetments. These walls are designed to manage wave attack and flooding potential. An additional 6.6 acres of new parkland would be created to the southeast of the existing park. This land would provide a buffer from Lake Michigan wave action and thus prevent the commonly occurring flooding of the Fullerton Parkway-Lake Shore Drive intersection. The additional land would also serve as a buffer to protect the historic Theater-on-the-Lake from future coastal erosion. Figure 3 illustrates a proposed project perspective sketch. Existing structure and proposed project plans are attached under separate cover. The project will include the following features:

- The 1700 feet of new revetment comprised of a stepped concrete promenade fronted by a steel sheet pile wall tied back with steel batter piles. Crushed stone or other clean fill will be used as a bedding layer. The new structure will be constructed on the lake side of the existing failing structure. On the north half of the revetment, the existing revetment will be encapsulated with the new wall structure. The new revetment will be very similar to the structure located immediately north of the project site, which was completed in 2005. However, the new structure will gradually reduce in size proceeding south as the wave attack stress is less due to shallower water or orientation of the revetment with respect to wave attack. The promenade width is 60.3 feet for the north 200 feet, then a width of 47 feet for the next 700 feet, then 37feet for the next 380 feet, and finally ranging from 28 feet to 37 feet for the remaining 420 feet.

- The southern portion of the shoreline is relocated to move the revetment structure farther from the adjacent roads to facilitate wave management and flood control. The southern end of the new revetment will encapsulate the existing dilapidated pier located 750 feet south of Fullerton Parkway (the southern side of failed beach cell). The new revetment will completely envelope the old pier and will anchor the south end of the project. The project will include the filling of 6.6 acres of the lake currently not accessible for public beach use, boating, or swimming due to the submerged sheet pile wall that was originally placed to support a beach which never materialized. The project will also include 90,000 cubic yards of fill below Ordinary High Water Mark (OHWM)

of 581.5 (LWD 85). The fill will be either clean Lake Michigan or upland fill sources. Shoreline areas upland of the revetment will be graded to provide for the safe conveyance of flood water that overtops the revetment back to Lake Michigan to ensure protection and control of adjacent upland and roadway areas. As a public benefit, the project will also significantly increase park space.

2) Public Participation Process and Activities

The Chicago Shoreline Protection Project was initially presented for discussion with community groups during December 1999 for the projects located on the north side of the city. Site visits were conducted in early 2000. A Lincoln Park Advisory Council (LPAC) Revetment Working Group was established for these projects. The initial concepts for this project area were developed utilizing the Lincoln Park Framework Plan. This plan was adopted by the Lincoln Park Steering Committee in June 1991 and was developed in partnership with the Chicago Park District. Many of the features and design details discussed during that time were carried forward into the current design concept. As the design concept has progressed through the normal design development process, the Fullerton-Theater on the Lake project has evolved in keeping with the original stakeholder input.

During the years 2001 and 2003, discussions were held at meetings with the LPAC Revetment Working Group and the Alderman for the north side projects to provide updates on planning level progress. During April 2009 The LPAC working group was provided with an update on the Fullerton-Theater on the Lake project to discuss the further evolution of the design development process completed at that point in time.

The Fullerton-Theater on the Lake project plan is in alignment with the Lincoln Park Framework Plan and incorporates many lessons-learned from other shoreline reaches that have been completed. The current plan status and refinements will be presented to the Alderman and community in a public meeting later in 2012. This meeting will occur prior to significant completion of the project plans and specifications.

3) Size, Type, and Habitat in Project Area

The project will include the filling of 6.6 acres of the lake. This area is currently not accessible for public beach use, boating, or swimming due to the submerged sheet pile wall that was originally placed to support a beach which never materialized. The project will also include 90,000 cubic yards of fill below the Ordinary High Water Mark (OHWM) of 581.5 (LWD 85). Normal lake level fluctuation, depth and shoreline development have all contributed to a lack of native submergent and emergent vegetation in the lake. Based on the lack of aquatic vegetation, it is assumed that the macroinvertebrate population is not very abundant. Turbidity levels fluctuate significantly during Lake Michigan storm conditions. This phenomenon is readily observed during storm events.

5) Timing and Duration of Construction

Construction of the project is anticipated to begin during 2012 and will be completed during 2014. The project sequencing will be as follows:

- Construction of a new steel sheet pile wall and supporting structures in the lake at the perimeter of the construction limits.

- Placement of crushed stone and other clean fill materials between the new wall and the existing shoreline revetment. Placements of fill from either clean Lake Michigan or upland fill sources will form the surface of the park area. Any clean sand to be used as fill will be sourced from the lake bottom located south or east of North Avenue Beach. This area contains excess submerged clean sand deposits that eventually travel with littoral currents to the south and are deposited into Chicago Harbor behind the existing breakwater structures.

- Construction of the concrete revetment structures along the shoreline.

- Construction of a lakefront trail system and stormwater management features.

- Placement of large armor stone in front of the steel sheet pile walls to provide erosion protection.

- After fill is placed, compacted, and graded, the area will be stabilized with vegetation, and new trees will be planted.

II. Factual Determinations

a. Physical Substrate Determinations

1) Substrate Conditions and Sediment Type

The construction of manmade fills and bulkheads in this region many decades ago dramatically altered this portion of the shoreline. Harbors, jetties, and breakwaters have diverted and trapped the littoral sand to form the current shoreline position that is in a relative state of equilibrium. Borings performed at the project site indicate the presence of 3 to 5 feet of poorly graded sand over clay or gravel on the lake bottom which is situated anywhere from 3 feet to 15 feet below the normal level of Lake Michigan. This deposit does not extend far offshore of the proposed shoreline revetment. Recent borings performed near North Avenue beach indicate the presence of clean sand deposits ranging in thickness from 2 feet to 8 feet. Eleven borings were taken in water depths of approximately 5 feet to 15 feet. This sand is generally classified as fine sand.

2) Material Movement

All clean fill placed for this project will be placed after significant portions of the shoreline revetment steel sheet pile wall is in place. In addition crushed rock or similar clean granular fill will be in place behind the steel wall for a minimum distance of approximately 25 feet. Thus, any fill placed to accomplish the new limits of the park will be contained within a confined area that is separated from Lake Michigan.

3) Physical Effects on Benthos

Benthic macroinvertebrates serve as the both a food source for fish and other organisms higher on the food chain and as primary consumers of organic matter on the lake bottom. The diversity, abundance and composition of the macroinvertebrate population can be affected by environmental factors, including overall water quality, substrate type, and the physical

parameters of temperature and current. While we are not aware of any studies performed at the project site, studies within the nearby Chicago Harbor (USCOE, 1982) have indicated that the Chicago Harbor maintains a viable macroinvertebrate community of mostly tolerant and facultative organisms. These studies identified 15 taxa from three samples collected from the Harbor. The number of organisms ranged from 8,670 to 48,146 individuals per square meter, and the dominant organism was the Tubificidaek- a tolerant aquatic work. A high number of snails, midges and crustaceans were also present.

Application of the biotic index, presented in the Illinois Environmental Protection Agency (IEPA) Macroinvertebrate Tolerance List (1996), provides unified historic benthic community data along the Chicago lakefront. Generally, the lakefront benthic community exhibits 14 IEPA-scored classes, families or genera with an average tolerance index of 6.14. This assessment indicates generally fair to poor water quality and occasional low dissolved oxygen. Lower population counts are observed in the summer than in the fall and spring; this is attributed to seasonal population cropping by foraging fishes.

Chironomids formed the bulk of the individuals collected, along with tubificid worms and other oligochetes. Mollusks observed were largely Sphaeriidae and Valvatidae snails; very few others were noted. Amphipodae could be locally abundant, due to contagious distribution of the organisms.

The proposed revetment is not expected to have any long term significant impacts to benthic macroinvertebrates. Short term impacts will occur in areas of proposed construction; however, the environment is expected to gain in terms of the diversity of lake bottom conditions that will occur with the placement of armor stone structures adjacent to the new revetment.

4) Clean Lake Sand Fill Source

Placements of fill from either clean Lake Michigan or upland fill sources will form the surface of the park area. Any clean lake bed sand to be used as fill would be sourced from the lake bottom located south or east of the main North Avenue beach pier. This area contains excess submerged clean sand deposits that eventually travel with littoral currents to the south and are ultimately deposited into Chicago Harbor.

The shoreline condition north and south of the Fullerton project is completely urbanized. There are numerous structures that exist in both directions that block the majority of sand transport along the shoreline. There are a series of beach cells immediately south of the project. These beach cells are stable in a long term sense and in a state of relative equilibrium from a sediment transport perspective. They will pick up sediment during periods of falling water levels such as we have experienced in the last decade, and lose sediment during periods of rising water levels. There is no source of significant sand sediment in the region due to the presence of hard edged structures at most locations, and interruptions from harbors and other man-made structures.

The proposed sand borrow will have limited or negligible impact on the sediment transport conditions existing in the vicinity of North Avenue Beach. The refilling of the borrow areas will temporarily cause a reduction in the amount of sand that finds its way into Chicago Harbor where this sand is of no practical environmental value, and could ultimately contribute to the need for future harbor sediment management.

5) Other Effects

There would be no other significant substrate impacts.

6) Actions Taken to Minimize Impacts

The proposed plan, including the shape of the land surface and amount of lake fill is the result of an optimization analysis. The analysis goal includes avoidance and minimization of project impacts to the extent possible while meeting the flood control requirements of the project. This process required a balancing between the shape, geometry, and elevation of the revetment structure at the edge of the park; the extent and scope of filling; and controlling the amount of wave overtopping flows that need to be managed to accomplish the flood control project objectives.

The proposed shoreline position alternative design provides a minimum amount of fill that satisfies the flood control requirements of the project. Following is a summary of the grading plan modifications that were incorporated into the selected option that keeps impacts to a minimum:

- The first 200 feet of revetment at the north end will match the existing revetment to the north of the project and then transition to a narrower revetment. The structure width reduction from 60.3 feet to 47 feet that comprises the next 700 feet of revetment and the revised shoreline position closer to the existing shore allows for a significant fill reduction. These changes reduce the water management performance of the revetment somewhat. As a result, upland ground elevations are increased somewhat to provide the necessary water management potential and to allow for a greater return of overtopping wave flows directly back to the lake. The net result is a significant fill reduction.

- The next 380 feet of revetment to the south is reduced in width even further to 37 feet for the same reason. Furthermore, wave climate analyses were refined and we found that the wave heights and overtopping flows are reduced proceeding to the south as the shoreline orientation begins to turn farther to the southwest, and within the partially protected areas of the south beach cell area.

- The remaining 420 feet of revetment will be constructed with a revetment width of 28 feet.

The refined upland ground contours also cause an overall reduction in the overtopping wave flows that are conveyed on the new park land and headed to the south. This water ultimately discharges over the south side of the lake fill as sheet flow to Lake Michigan. The width of this flow path needed to convey the flow without flooding of the adjacent roadways to the west is determined by the rate of flow and associated flow depths. These flow parameters are also controlled by the flow path slope.

Several other revetment shapes and concepts were considered. The inclusion of a parapet wall was investigated as a potential means of further reducing the revetment width and overtopping flows. This analysis indicates that no appreciable difference in overtopping flows would be accomplished by trading off a narrower revetment width for a parapet wall on the lake side edge. The parapet wall would significantly alter the design concept adopted for the project and create some complexities with respect to drainage and other design concerns. Furthermore, this option did not provide a cost advantage since the parapet wall would need to be substantial in its shape, and would also need to include some architectural nuances to make it look reasonably aesthetically pleasing.

The design team considered alternative revetment concepts including cellular sheet pile structures, precast elements, king pile of HZ wall systems, articulated concrete steps, and use of precast concrete gravity structures instead of cast in place concrete. None of these options were determined to reduce the amount of overtopping flows or the amount and extent of lake fill. Further, some of these options are not considered feasible from a cost or structural capability perspective.

The selected park plan form and associated fill amount was thus optimized to reduce the amount of fill. The original proposed shoreline concept plan would have required approximately 330,000 cubic yards (8.6 acres) of fill with 130,000 cubic yards of this fill below the OHWM of 581.5 (LWD 85). The selected optimized shoreline concept will result in approximately 240,000 cubic yards (6.6 acres) of fill with approximately 90,000 cubic yards of this fill below the OHWM. In addition to this fill, 16,500 cubic yards of armor stone will be placed adjacent to the toe of the new revetment to provide wave protection required for this vertical walled structure. The stone provides protection against erosion of the lake bed adjacent to the revetment when it is attacked by wave action.

b. Water Quality, Circulation, and Fluctuation

1) Water Quality

There are no comprehensive water quality data available for this site. None of the agencies contacted indicate that the lake is monitored on a regular basis except for the water supply intake sites, and that data is not readily available. Limited information is available (JJR, 1991) as follows:

- MWRD evaluated various water quality parameters as part of the Operation Lake Watch Program between 1980 and 1985 at seven shoreline locations. During 1985 various nutrients and pollutant parameters were monitored on a monthly basis from February to November. These data generally exceeded the Water Quality Standards for Lake Michigan waters designated by the State of Illinois. Fecal coliform levels have at times exceeded standards and there have been reports of beach closings over the years.

- WAPORA, Inc. initiated a water quality evaluation at navy Pier in 1980 and found dissolved Oxygen levels to average 8.7 mg/l and secchi disk depth was 16 feet – both indications of good water quality.

Turbidity levels fluctuate significantly during Lake Michigan storm conditions. This phenomenon is readily observed during storm events.

Water quality monitoring conducted by IEPA during 2006 at Diversey Harbor indicates the following:

- Dissolved oxygen generally ranged between 6.1 and 11.3 mg/l. Most readings were in the 8 to 9.5 mg/l range. The lowest readings occurred in shallow areas of the harbor during summer months.

- Oxygen levels generally reduce with depth however, the reduction is not significant in all but the most shallow sample locations.

- Secchi disc depth readings range from 1.2 feet to 9 feet. The lower readings tend to occur in the more shallow sites. The deeper water sample sites generally produce readings in the range of 6.5 to 9 feet.

A 1982 study completed as part of a Cook County environmental assessment (USCOE, 1982) indicates that the water quality of Lake Michigan is highly variable and at times does not meet the water quality standards for Lake Michigan. Reference is made to periods of stagnant water and algae blooms. However, the water quality is sufficient to support a viable benthic and fish population.

The project is not expected to have any significant impacts to water quality.

2) Current Patterns and Circulation

The current patterns, flow, velocity of water, and Lake Michigan wave action will not be altered during implementation of the project, or after completion. The Fullerton shoreline structures are designed to maintain existing wave conditions without change. The orientation of the structures is the same as existing structures from the perspective of wave reflection and absorption in the vicinity of the project site. Therefore, the project will have no adverse impacts on nearshore wave conditions.

3) Normal Water Level Fluctuations

Lake Michigan water levels including storm surge have fluctuated from an extreme high of +6.2 LWD to an extreme low – 3.6 LWD for the period of record between 1903 and 2008. The normal seasonal fluctuations of the lake surface fluctuate in the range of one to two feet. The following table summarizes the extreme water levels recorded for the Calumet Harbor gage:

	Extreme Water Levels (LWD)			
Water Level Description	**Maximum**	**Date**	**Minimum**	**Date**
Instantaneous High/Low	+6.2	02\08\1987	-3.6	10\11\1940
Daily Mean Level	+5.3	10/04/1986	-2.4	01/31/1934
Monthly Mean Level	+4.9	10/1986	-1.5	02/1964
Annual Mean Level	+4.2	1986	-1.1	1964

The project will have no impact on water levels.

4) Actions Taken to Minimize Impacts

The proposed Fullerton shoreline structures and fill are designed to maintain existing wave conditions without change. The orientation of the structures is the same as existing structures from the perspective of wave reflection and absorption in the vicinity of the project site. The shoreline position is designed to be tucked within the regional profile between the existing Fullerton revetment, and the North Avenue beach pier. Therefore, the project will have no adverse impacts on nearshore wave conditions.

c. Suspended Particulate/Turbidity Determinations

1) Expected Changes in Suspended Particulates and Turbidity

There will be limited increases in suspended particulates and turbidity levels in the immediate area of the proposed shoreline revetment construction. The steel sheet pile revetment wall will be in place prior to the placement of non-stone upland fill thereby keeping impacts to a minimum. The potential submerged clean sand borrow location is comprised of fine sand. Temporary turbidity would occur during the sand borrow operation. Since this material is clean sand, the amount of turbidity will not be significant. The placement of clean lake sand or upland clean fill at the Fullerton site will take place within a confined area formed to provide separation between the fill activity and Lake Michigan. If the placement of lake sand in the fill area results in any potential decant of water to the lake, the decant water will be subjected to the water quality permit requirements established by the IEPA.

2) Effects on Chemical and Physical Properties of Water Column

a. Light penetration – localized turbidity increases would cause decrease on light penetration.
b. Dissolved oxygen – Lake Michigan generally exhibits high levels of dissolved oxygen. The small area of potential minor turbidity increases will not have a significant impact on dissolved oxygen.

3) Effects on Biota

No significant impact on aquatic biota is expected to result from turbidity or suspended particulates associated with revetment construction or sand borrow activities.

4) Actions Taken to Minimize Impacts

Potential water decanting from the Fullerton confined fill area would be monitored and treated as necessary to meet applicable regulatory requirements. Applicable permits will be secured and the work will be coordinated with the regulatory agencies, including the IEPA and IDNR.

d. Contaminant Determination

Lake bottom sediment sampling was performed to characterize the sand sediment present within the sand borrow area from eleven lake bed sites. Grain size analysis curves for the eleven sample sites indicate the material is fine sand. Analytical chemical testing was performed at four boring locations. One test was performed for each test site for USEPA TCL parameters (totals). For sediment supernatant parameters, one background water sample test was performed and four sediment samples were tested for the following durations at each test site: 4 hrs, 24hrs, and 48 hrs. SVOC's were tested for 4 hr and 24 hr durations. Finally, one asbestos PLM test was performed at three test locations. A summary of the sediment analysis results are provided on Tables 1 through 4. Following is a summary of sediment analysis results:

- Sediment at the sample locations is generally classified as fine sand. The sand deposits vary from approximately 2 feet to 8 feet deep northeast of the south end of North Avenue Beach. On the southeast side of the North Avenue pier, the sand thickness varies from 4 feet to 6 feet.

- The area to the Northeast of the North Avenue pier contains approximately 25,000 to 50,000 cubic yards of sand, and the area to the southeast of the pier contains about 30,000 to 70,000 cubic yards of sand. The amount of sand proposed to be used for the Fullerton project site is approximately 70,000 cubic yards. The use of this sand as a fill source for the project would result in a reduction of approximately 5000 less truck round trips if an upland fill source is used.

- Sediment analytical results are as follows:
    - Metals – All results are below TACO Tier 1 residential soil cleanup objectives, and below Class I groundwater ingestion exposure route values.
    - All other TCL parameters have non-detect results.

- Asbestos Polarized Light Microscopy – all four samples have non-detect results.

- Sediment Supernatant Testing –
    - Metals -- of the 84 tests, 76 registered non-detect results, and 8 recorded minor detection. All exceed the Lake Michigan drinking water standards.
    - TSS – results range from 9 to 14 mg/l
    - Ammonia (as N) – All 4 and 24hr tests are non-detect.
    - Phosphate (Total as P) – The sand areas are located within the surf zone. As such, this material is naturally disturbed and moved by littoral currents on a regular basis. The background water sample indicates a reading of 0.029 mg/l. The supernatant testing indicates a range of non-detect to 0.023.

e. <u>Aquatic Ecosystem and Organism Determinations</u>

1) Effects on Plankton

Plankton is considered to be a bio-indicator of changes to the chemical and physical parameters of the aquatic environment. Copepods, small crustaceans found in nearly every freshwater habitat, constitute the largest source of available protein in the open ocean and are considered a cornerstone of the aquatic food chain.

In Lake Michigan, historic plankton counts have always indicated that diatoms were the dominant algal taxa, due to the high availability of silica (for their microscopic glass-like shells or “valves”) and the low nutrient levels. Now that Chicago’s inshore waters have become more eutrophic, green and blue-green algae have become locally dominant, but in open waters, diatoms still predominate. In aquatic ecosystems, plankton populations experience seasonal fluctuations in species composition and abundance. Zooplankton, which feed upon phytoplankton, follows the same seasonal cycles as their prey. This tandem fluctuation is a classic predator-prey population cycle. Zooplankton sees population pressure from both the availability of phytoplankton and the predation of larval fishes.

In Savitz (1993), 33 generae of phytoplankton are identified during the summer in the several reference harbors. Pennate diatoms Fragilaria and Asterionella tend to dominate throughout the

year, sharing seasonal dominance with the common, chain-forming Tabellaria diatoms in the spring. The blue-green alga Anabaena, the green algae Oedogonium, Scenedesmus and Ulothrix, are also abundant.

In this same study, copepods and daphnia were found to comprise the bulk of the zooplankton year round, with seasonal populations of rotifers Brachionus and Keratella. Zooplankton numbers were generally low. It is unlikely that zooplankton provide much forage for any but the smallest larval fishes and even then, the low numbers would restrict how many of these fishes would become part of the adult population. Table 5 summarizes the Plankton population from the referenced studies.

Table 5
Seasonal Plankton Population (Raw Counts), Pooled Samples from Years 1988 to 1990
Selected Chicago Harbors (Montrose, Belmont and Burnham),

Species	**Spring Count**	**Summer Count**	**Autumn Count**	**Winter Count**
		Phytoplankton		
Anabaena		406		
Ankistrodesmus		108		
Asterionella	4328	779	12	2
Ceratium		46		
Chlorella		6		
Closterium		112		
Cosmarium		2		
Cyclotella		36		
Cymbella	7			7
Dinobryon		185		
Fragilaria	43268	3303	2326	800
Gomphpspaeria		3		
Oedogonium	1281	188	23	219
Oscilliatoria		4		
Pediastrum		1		
Scenedesmus	6490	41		
Spirogira	92	34		
Staurastrum		2		
Synedra		16		
Tabellaria	43963	774	98	498
Ulothrix		643		
Volvox		12		
Unidentified		179		3
		Zooplankton		
Alona		2		
Bosmina		72		
Brachionus	47			
Copepods	2	50	12	25
Daphnia	1	96	43	9
Keratella	21	20	2	
Protozoa	7			
Hydracarina	13	2		
Total Individuals	**99520**	**7122**	**2516**	**1593**

Minor, temporary impacts on light penetration would temporarily lower photosynthesis and other related metabolic functions in phytoplankton; this would not be a significant impact.

2) Effects on Benthos

Refer to section II.a.3)

3) Effects on Nekton

Fish eggs and larvae may be smothered by the proposed fill activity; however, this would be a minor, temporary impact. Fish and other free-swimming organisms will tend to avoid the construction area; the construction area will be used again by those organisms soon after construction ends. Species requiring rocky substrate for foraging and reproduction would be favored over those requiring sandy bottom habitats.

4) Effects on Aquatic Food Web

No significant long-term impacts on the food web are expected.

5) Effects on Aquatic Sites

a) Sanctuaries and Refuges – none present; no significant impact
b) Wetlands – none present; no significant impact
c) Mud Flats – none present; no significant impact
d) Vegetated Shallows – none present; no significant impact
e) Coral Reefs – not applicable to freshwater environments
f) Riffle and Pool Complexes – none present; no significant impact

6) Threatened and Endangered Species

No state- or federally-listed threatened and endangered species are known to be present within the project area. The site is within the range of the federally endangered Indiana Bat (*Myotis sodalist)* the Karner blue butterfly (*Lycaeides Melissa samuelis),* the threatened Pitcher's thistle (*Cirsium pitcheri*), and the candidate eastern massasauga rattlesnake (*Sistrurus catenatus catenatus).* However, the project area contains no habitat likely to be used by threatened or endangered species with the possible exception of migratory avian species. Due to the nature of the project area as a disturbed urban lacustrine environment, no species of rare, threatened or endangered plants will be affected by the project. Four species of fish in Lake Michigan are listed as threatened by the state of Illinois; the lake sturgeon, the longnose sucker, the cisco and the lake whitefish. These fish have specific habitat requirements which do not occur within the project area. These fish are commonly found in deep water habitats. Accordingly, these species are not likely to be affected by the project. Table 6 provides a summary of rare, threatened and endangered bird and fish species with potential to be in the project area.

TABLE 6 Rare, Threatened & Endangered Species (Motile Populations) With Potential Presence in the Project Area		
Fish Species		
Species Name	Status	Habitat
Acipenser fulvescens Lake Sturgeon	Threatened	Bottom-dweller of lakes and large rivers; 4-9m deep, over mud, sand and gravel bottoms
Catostomus catastomus Longnose Sucker	Threatened	Prefers clear, cold, deep (> 8 m) water of lakes and tributaries.
Coregonus artedii Cisco	Threatened	Deep water lake fish; all-season depth range of 15-55m.
Coregonus clupeaformis Lake Whitefish	Threatened	Deep water lake fish; found at depths up to 128m.
Bird Species*		
Species Name	Status	Habitat
Ammodramus henslowii Henslow's Sparrow	Threatened	Area-sensitive grassland bird; prefers grassy areas > 50 ha in size. Migrant.
Botaurus lentiginosus American bittern	Endangered	Reclusive wading bird of marshes and shallow lakeshores.
Chlidonias niger Black Tern	Endangered	Freshwater marshes and shallow ponds, lakes and large wetlands. Rare migrant.
Nycticorax nycticorax Black crowned night heron	Endangered	Summer resident of bottomland forest, willow or cottonwood thickets. Visitors from Lake Calumet colony, Cook County, Illinois.
Pandion haliaetus Osprey	Endangered	Summer resident; coastal areas where fish are abundant. Migrant.
Sterna forteri Forster's Tern	Endangered	Marsh-bordered lakes. Common migrant and rare resident in Illinois. Inland nester in Chain-o-Lakes area, Lake County, Illinois.
Sterna hirundo Common Tern	Endangered	Colonial nester in sand and pebble beaches. Common migrant. Colony at Illinois Beach State Park, Lake County, Illinois.

*Bird species presented here were observed in the vicinity of Navy Pier by Eisman and Shank in 1962. List modified through personal communication with Doug Stotz, Ornithologist at the Chicago Field Museum. Habitat synopses from "Endangered and Threatened Species of Illinois: Status and Distribution, Volume 2 – Animals." Illinois Endangered Species Protection Board, 1991.

Seven species of threatened and endangered birds are reported to have been observed along the Chicago lakefront. The species are passing migrants and would not have breeding or other critical habitat that would be affected by the project. None of these species will be affected by the project.

7) Other Wildlife

Wildlife use of the project area is limited and consists primarily of birds and mammals common to developed lakeshore and urban areas. Species include common songbirds, pigeons, ducks, geese, gulls and other waterbirds, and small mammals such as mice and rats, bats, possum, squirrels and raccoons. The Lake Michigan shoreline is part of a known migratory flyway; seasonally, many migratory birds can be identified passing through the project area.

8) Actions Taken to Minimize Impacts

No special actions would be taken to minimize impacts on the aquatic ecosystem.

f. Proposed Discharge Site Determinations

1) Mixing Zone Determination

A mixing zone is not applicable to this project as no violation of applicable water quality standards is expected during construction.

2) Determination of Compliance with Applicable Water Quality Standards

The proposed activity would not cause significant or long-term degradation of water quality within Lake Michigan and would comply will all applicable water quality standards.

3) Potential Effects on Human use Characteristics

No significant long-term negative impacts to municipal and private water supplies, water-related recreation, aesthetics, recreational, or commercial fisheries are expected. During project implementation, recreational uses of the Lake will be limited within the construction work limits. No known National Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves are present. North of Montrose Harbor in Lincoln Park is the Montrose Hill Bird Sanctuary. Located north of the project area, this naturalized area of the park provides habitat as well as a feeding and resting area for migrating birds during spring and fall migrations.

g. Cumulative Effects on the Aquatic Ecosystem

There are no significant cumulative adverse effects expected as a result of implementation of the Fullerton shoreline project.

h. Secondary Effects on the Aquatic Ecosystem

No significant impacts on the Lake Michigan ecosystem are expected as a result of the proposed activity.

III. Findings of Compliance with the Restrictions on Discharge

a. No adaptation of the Section 404(b) (1) guidelines was made for this evaluation.

b. No practical alternatives are available that produce fewer adverse aquatic impacts than the proposed plan.

c. The proposed project would comply with applicable water quality standards.

d. The project is in compliance with applicable Toxic Effluent Standards under Section 307 of the Clean Water Act; with the Endangered Species Act of 1973; with the National Historic Preservation Act of 1966; and with the Marine Protection, Research, and Sanctuaries Act of 1972.

e. The proposed activities would have no significant adverse impact on human health or welfare, including municipal and private water supplies, recreational and commercial fisheries, plankton, fish, shellfish, or wildlife communities (including community diversity, productivity, and stability), special aquatic sites, or recreational, aesthetic, and economic values.

f. No special measures were taken to minimize construction impacts other than selection of the least environmentally damaging construction alternative.

g. On the basis of the Guidelines, the proposed discharge of fill material and clean sand borrow activity is specified as complying with the requirements of these guidelines with the inclusion of appropriate and practical conditions to minimize pollution or adverse impacts to the aquatic ecosystem.

Date _____

_____
Frederic A. Drummond, Jr.
Colonel, U.S. Army
District Commander

Table -- 1
Metals and General Chemistry
Target Analyte List - Laboratory Analytical Results
North Avenue Beach

			Received	6			7			10			11		
		Field Sample ID	**Water**	**4 hours**	**24 hours**	**48 hours**	**4 hours**	**24 hours**	**48 hours**	**4 hours**	**24 hours**	**48 hours**	**4 hours**	**24 hours**	**48 hours**
		Date of Sample Collection:	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011
		Time of Sample Collection:	no time	9:40 AM			9:30 AM			8:50 AM			9:05 AM		
		GAL Sample ID	1101001-17	1101001-05	1101001-09	1101001-13	1101001-06	1101001-10	1101001-14	1101001-07	1101001-11	1101001-15	1101001-08	1101001-12	1101001-16
Total Metals (6010B)	**Units**	**Rep. Limit**													
Arsenic	mg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Cadmium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.005**	<0.001	<0.001	<0.001	<0.001
Lead	mg/L	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	**0.007**	<0.002	**0.005**	<0.002	**0.003**	<0.002	**0.009**
Nickel	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	**0.005**	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	**0.043**	<0.005	<0.005	<0.005	**0.008**
Total Metals (7470A)	**Units**	**Rep. Limit**													
Mercury	mg/L	0.050	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Wet Chemistry	**Units**	**Rep. Limit**													
Total Hardness, as CaCO3	mg/L	5	**135**	**154**	**166**	**169**	**125**	**158**	**158**	**136**	**166**	**182**	**140**	**154**	**170**
Total Dissolved Solids	mg/L	10	**163**	**145**	**207**	**93**	**167**	**172**	**173**	**166**	**183**	**197**	**158**	**183**	**182**
Total Suspended Solids	mg/L	1	**2**	**9**	**9**	**4**	**7**	**7**	**8**	**7**	**7**	**9**	**8**	**14**	**14**
Total Volatile Solids	mg/L	10	**113**	**76**	**62**	**60**	**109**	**95**	**65**	**40**	**65**	**68**	**69**	**64**	**58**
Ammonia (as N)	mg/L	0.1	<0.1	<0.1	<0.1	**1.38**	<0.1	<0.1	**1.47**	<0.1	<0.1	**1.08**	<0.1	<0.1	**1.41**
Chloride	mg/L	5	**12**	**12**	**12**	**31**	**12**	**12**	**30**	**12**	**12**	**28**	**12**	**12**	**28**
Sulfate	mg/L	15	**26**	**29**	**34**	**14**	**29**	**35**	**13**	**27**	**32**	**13**	**27**	**31**	**13**
Phosphate (Total as P)	mg/L	0.01	**0.029**	**0.013**	<0.010	**0.023**	<0.010	**0.013**	<0.010	**0.023**	**0.013**	**0.042**	<0.010	**0.02**	**0.023**

mg/L = milligrams per Liter

Table -- 2
Pesticides and PCBs
Target Analyte List - Laboratory Analytical Results
North Avenue Beach

			Received	6	6	6	7	7	7	10	10	10	11	11	11
		Field Sample ID	**Water**	**4 hours**	**24 hours**	**48 hours**	**4 hours**	**24 hours**	**48 hours**	**4 hours**	**24 hours**	**48 hours**	**4 hours**	**24 hours**	**48 hours**
		Date of Sample Collection:	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011
		Time of Sample Collection:	no time	9:40 AM			9:30 AM			8:50 AM			9:05 AM		
		Date Analyzed:	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011
		GAL Sample ID	1101001-17	1101001-05	1101001-09	1101001-13	1101001-06	1101001-10	1101001-14	1101001-07	1101001-11	1101001-15	1101001-08	1101001-12	1101001-16
Pesticides (8081A)	**Units**	**Rep. Limit**													
4,4´-DDD	ug/kg dry	16.00	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0
4,4´-DDE	ug/kg dry	16.00	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0
4,4´-DDT	ug/kg dry	16.00	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0
Aldrin	ug/kg dry	8.00	<8.00	<8.01	<8.02	<8.03	<8.04	<8.05	<8.06	<8.07	<8.08	<8.09	<8.10	<8.11	<8.12
alpha-BHC	ug/kg dry	0.13	<0.13	<0.14	<0.15	<0.16	<0.17	<0.18	<0.19	<0.20	<0.21	<0.22	<0.23	<0.24	<0.25
Aroclor-1016	ug/kg dry	80.00	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0
Aroclor-1221	ug/kg dry	80.00	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0
Aroclor-1232	ug/kg dry	80.00	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0
Aroclor-1242	ug/kg dry	80.00	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0
Aroclor-1248	ug/kg dry	80.00	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0	<80.0
Aroclor-1254	ug/kg dry	160.00	<160	<160	<160	<160	<160	<160	<160	<160	<160	<160	<160	<160	<160
Aroclor-1260	ug/kg dry	160.00	<160	<160	<160	<160	<160	<160	<160	<160	<160	<160	<160	<160	<160
beta-BHC	ug/kg dry	8.00	<8.00	<8.01	<8.02	<8.03	<8.04	<8.05	<8.06	<8.07	<8.08	<8.09	<8.10	<8.11	<8.12
Chlordane	ug/kg dry	80.00	<80.0	<80.1	<80.2	<80.3	<80.4	<80.5	<80.6	<80.7	<80.8	<80.9	<80.10	<80.11	<80.12
delta-BHC	ug/kg dry	8.00	<8.0	<8.1	<8.2	<8.3	<8.4	<8.5	<8.6	<8.7	<8.8	<8.9	<8.10	<8.11	<8.12
Dieldrin	ug/kg dry	16.00	<16.0	<16.1	<16.2	<16.3	<16.4	<16.5	<16.6	<16.7	<16.8	<16.9	<16.10	<16.11	<16.12
Endosulfan I	ug/kg dry	8.00	<8.00	<8.01	<8.02	<8.03	<8.04	<8.05	<8.06	<8.07	<8.08	<8.09	<8.10	<8.11	<8.12
Endosulfan II	ug/kg dry	16.00	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0
Endosulfan sulfate	ug/kg dry	16.00	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0
Endrin	ug/kg dry	16.00	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0
Endrin aldehyde	ug/kg dry	16.00	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0
Endrin ketone	ug/kg dry	16.00	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0	<16.0
gamma-BHC (Lindane)	ug/kg dry	8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00
Heptachlor	ug/kg dry	8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00
Heptachlor epoxide	ug/kg dry	8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00	<8.00
Methoxychlor	ug/kg dry	80.00	<80.0	<80.1	<80.2	<80.3	<80.4	<80.5	<80.6	<80.7	<80.8	<80.9	<80.10	<80.11	<80.12
Toxaphene	ug/kg dry	160.00	<160	<161	<162	<163	<164	<165	<166	<167	<168	<169	<170	<171	<172

mg/L = milligrams per liter

Table -- 3
Semi-volatile Organic Compounds
Target Analyte List - Laboratory Analytical Results
North Avenue Beach

				Supernantant											
			Received	6	6	6	7	7	7	10	10	10	11	11	11
			Water	4 hours	24 hours	48 hours	4 hours	24 hours	48 hours	4 hours	24 hours	48 hours	4 hours	24 hours	48 hours
Date of Sample Collection:			10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011	10/8/2011
Time of Sample Collection:			no time	9:40 AM			9:30 AM			8:50 AM			9:05 AM		
Date Analyzed:			10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011	10/26/2011
GAL Laboratory ID			1101001-17	1101001-05	1101001-09	1101001-13	1101001-06	1101001-10	1101001-14	1101001-07	1101001-11	1101001-15	1101001-08	1101001-12	1101001-16
SVOCs (8270C)	**Units**	**Rep. Limit**													
1,2,4-Trichlorobenzene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
1,2-Dichlorobenzene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
1,3-Dichlorobenzene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
1,4-Dichlorobenzene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
2,4,5-Trichlorophenol	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
2,4,6-Trichlorophenol	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
2,4-Dichlorophenol	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
2,4-Dimethylphenol	ug/L	1.3	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30
2,4-Dinitrophenol	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
2,4-Dinitrotoluene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
2,6-Dinitrotoluene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
2-Chloronaphthalene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
2-Chlorophenol	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
2-Methylnaphthalene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
2-Methylphenol	ug/L	2.3	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30	<2.30
2-Nitroaniline	ug/L	3.3	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30
2-Nitrophenol	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
3,3´-Dichlorobenzidine	ug/L	1.3	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30
3/4-Methylphenol	ug/L	1.3	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30
3-Nitroaniline	ug/L	3.3	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30
4,6-Dinitro-2-methylphenol	ug/L	2	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00
4-Bromophenyl phenyl ether	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
4-Chloro-3-methylphenol	ug/L	1.3	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30
4-Chloroaniline	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
4-Chlorophenyl phenyl ether	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
4-Nitroaniline	ug/L	3.3	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30
4-Nitrophenol	ug/L	3.3	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30	<3.30
Acenaphthene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Acenaphthylene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Anthracene	ug/L	0.9	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90	<0.90
Benzo (a) anthracene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Benzo (a) pyrene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Benzo (b) fluoranthene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Benzo (g,h,i) perylene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Benzo (k) fluoranthene	ug/L	1.8	<1.80	<1.80	<1.80	<1.80	<1.80	<1.80	<1.80	<1.80	<1.80	<1.80	<1.80	<1.80	<1.80
Benzyl alcohol	ug/L	1.3	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30
Bis(2-chloroethoxy)methane	ug/L	1.5	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50
Bis(2-chloroethyl)ether	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Bis(2-chloroisopropyl)ether	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Bis(2-ethylhexyl)phthalate	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Butyl benzyl phthalate	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Carbazole	ug/L	0.8	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80
Chrysene	ug/L	1.3	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30
Dibenz (a,h) anthracene	ug/L	0.4	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Dibenzofuran	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Diethyl phthalate	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Dimethyl phthalate	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Di-n-butyl phthalate	ug/L	0.5	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Di-n-octyl phthalate	ug/L	0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86	<0.86
Fluoranthene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Fluorene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Hexachlorobenzene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Hexachlorobutadiene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Hexachlorocyclopentadiene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Hexachloroethane	ug/L	0.8	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80	<0.80
Indeno(1,2,3-cd)pyrene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Isophorone	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Naphthalene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Nitrobenzene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
N-Nitrosodi-n-propylamine	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
N-Nitrosodiphenylamine	ug/L	0.67	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67	<0.67
Pentachlorophenol	ug/L	1.5	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50	<1.50
Phenanthrene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66
Phenol	ug/L	1.3	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30	<1.30
Pyrene	ug/L	0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66	<0.66

ug/L = micrograms per liter

Table -- 4
Metals and Cyanide in Sediment
Laboratory Analytical Results - Target Analyte List
North Avenue Beach

		Field Sample ID:	6	7	10	11	Tier 1 Residential Soil Cleanup Objectives		Soil Component of the Groundwater Ingest Exposure Route Value	
		Date of Sample Collection:	10/8/2011	10/8/2011	10/8/2011	10/8/2011				
		Time of Sample Collection:	9:40	9:30	8:50	9:05	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)
		GAL Sample ID	1101001-01	1101001-02	1101001-03	1101001-04				
Cyanide, Total (4500CN,C,E)										
Analyzed:	Units	Rep. Limit	10/17/2011	10/17/2011	10/17/2011	10/17/2011				
Cyanide, To	mg/kg	0.10	<0.10	<0.10	<0.10	<0.10	1,600	---	40	120
Total Metals (6010B)										
Analyzed:	Units	Rep. Limit	10/13/2011	10/13/2011	10/13/2011	10/13/2011				
Aluminum	mg/kg	5.0	1690	1650	1620	1070	NE	NE	-	-
Antimony	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	31	C	5	20
Arsenic	mg/kg	0.2	2.7	2.9	2.6	2.9	13	750	30	120
Barium	mg/kg	0.1	7.4	7.0	7.2	4.4	5,500	690,000	1,800	1,800
Beryllium	mg/kg	0.1	<1.0	<1.0	<1.0	<1.0	160	1,300	1,000	130,000
Cadmium	mg/kg	0.1	<1.0	<1.0	<1.0	<1.0	78	1,800	59	590
Calcium	mg/kg	10	92600	78900	92300	44900	G	C	-	-
Chromium	mg/kg	0.1	5.3	4.3	4.8	3.0	230	270	32	-
Cobalt	mg/kg	0.1	3.2	3.1	3.1	2.1	4,700	C	-	-
Copper	mg/kg	0.1	3.1	5.1	2.6	1.8	2,900	C	330,000	330,000
Iron	mg/kg	1.0	5980	5230	5680	3760	C	C	-	-
Lead	mg/kg	0.2	5.7	4.8	3.7	6.2	400	C	107	1,420
Magnesium	mg/kg	10	47100	39000	45200	24600	325,000	C	-	-
Manganese	mg/kg	0.1	287	247	274	177	1,600	69,000	-	-
Nickel	mg/kg	0.1	2.1	2.3	2.0	1.7	1,600	13,000	700	14,000
Potassium	mg/kg	10	283	301	283	167	G	C	-	-
Selenium	mg/kg	0.2	<0.2	<0.2	<0.2	<0.3	390	C	3.3	3.3
Silver	mg/kg	0.1	<1.0	<1.0	<1.0	<1.1	390	C	39	-
Sodium	mg/kg	10	409	145	160	78	G	C	-	-
Thallium	mg/kg	1.0	<1.0	<1.0	<1.0	<1.0	6.3	C	3.4	34
Vanadium	mg/kg	1.0	19.7	14.5	19.7	6.7	550	C	980	-
Zinc	mg/kg	0.5	30.9	19.2	30.7	32.1	23,000	C	16,000	32,000
Total Metals (7470A)										
Analyzed:	Units	Rep. Limit	6/23/2006	6/23/2006	6/23/2006	6/23/2006				
Mercury	mg/kg	0.05	<0.05	0.10	0.51	0.43	23	10	6.4	32

mg/kg = milligrams per kilogram

Denotes values that exceed criteria

NE - Not Established

Source of Cleanup Objectives - 35 IAC Subtitle G Chapter I Subchapter F Section 742 Appendix B Table A Tier 1 soil Remediation Objectives for Residential Properties:

*C - No toxicity criteria available for the route of exposure

*G - chemical-specific properties are such that this route is not of concern at any soil contaminant concentration

Soil component for the groundwater ingestion route uses the pH specific tables from Appendix B Tables C and D with units a pH from June 2006 testing of pH with an average value of 7.45

Bold denotes exceeded criteria