Shabica & Associates, Inc.

Federal Consistency Coordinator
Illinois Coastal Management Program
Illinois Department of Natural Resources
160 N. LaSalle Street, Suite 700
Chicago, IL 60601

To Whom It May Concern: March 12, 2024

In compliance with the Illinois Coastal Management Federal Consistency Review Procedures, we provide the following information for a breakwater-protected beach and sand nourishment for the properties located at 255 and 261 N. Mayflower Road, Lake Forest, IL 60045, owned by David Moore.

Location of Project
The proposed breakwater-protected beach system will be built on the lakefront of the properties located at 255 and 261 N. Mayflower Road, Lake Forest, IL 60045, owned by David Moore.

Project Start Date and Duration
Work will not begin until all necessary permits have been received. It is anticipated that the project can begin by August 15, 2024. This work will require approximately 15 weeks to complete.

Extent of Work to be Conducted

Beginning at the north end of 261, construct a 55' long breakwater spur to the south. After a 40' gap, reconstruct and extend the gumball into a 140' long quarrystone breakwater extending 100' north of the existing steel groin and 40' south. The breakwaters will have a crest elevation of 586' with an 11' wide crest and slopes of 1:1.5. A steel pier on piles will be constructed over the existing steel groin that is on the property line between 255 and 261. The pier will have a width of 6 feet and a crest of 585'. Once the pier intersects with the breakwater crest there will be a pier deck on open piles over the crest that is 20' long with an extension lakeward to the toe of the breakwater stone for fishing and boat access. There will be stone wave attenuators (serving as toe protection also) along the north side of the pier/groin and on the south side of the southernmost groin with a crest of 586'(N) and 585'(S) and slopes of 1:1. Maintenance will be done in the form of filling voids on the existing south breakwaters. Finally, a steel cap will be installed on the short groin second from the south to groin stability. Per mitigational sandfill requirements, 2,536 cubic yards of clean quarried sand will be placed. New fill will cover 0.17 acres below the visual OHWM. All work will be within 125' of the existing steel seawall.

This permit request includes optional sand nourishment for 10 years in a quantity up to 1500 tons of sand. The sand will only be placed as needed pending site condition – typically based on water level and lake storms.

Contact Information

All questions pertaining to this project can be submitted to:

Jon Shabica
Shabica & Associates, Inc.
550 Frontage Road, Suite 3735
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847-446-1436 Tel

The proposed activity complies with Illinois' approved Coastal Management Program and will be conducted in a manner consistent with such policies.

Sincerely,

Jon Shabica
Vice President

2021 Google Earth – Approximate property lines in yellow

Shabica & Associates, Inc.

Teralyn Pompeii, PE
Chief, Regulatory Branch
U.S. Army Corps of Engineers, Chicago District
231 S. LaSalle Street, Suite 1500
Chicago, IL 60604

Dear Ms. Pompeii: February 12, 2024, rev. from Oct. 3, 2022, rev. from June 30, 2022

The project previously applied for is being modified as Mr. David Moore has acquired the property at 261 Mayflower Road as Mr. LaPlace has passed. Please find enclosed a modified permit application for shore protection work for the properties located at 255 and 261 N. Mayflower Road, Lake Forest, IL, owned by David Moore. The shore protection work will be comprised of enhancing the existing shore protection system to help protect the property from Lake Michigan stormwaves. The work is designed to help reduce incident wave energy from eroding the sand and clay lakebed, to create a more sustainable sand cover over the clay lakebed which helps to reduce lakebed downcutting (deepening of the water), to help improve water quality caused by colloidal fines from the eroding clay being suspended in the water during storms, and to help reduce wave energy impacting the revetment in the bays.

A *Design of Shoreline Erosion Protection* report has been attached to this cover letter as the coastal design specifications component of this permit. All references and figures referred to in the cover letter and the following report can be found in the Appendix.

The proposed activity complies with the approved Illinois Coastal Management Program and will be conducted in a manner consistent with such policies.

Project Purpose Statement

The property owner has retained Shabica & Associates (SA) to help protect the properties located at 255 and 261 N. Mayflower Road, Lake Forest, IL. The purpose of this project is to help provide a higher level of shore protection for the bluff and lakebed by breaking waves further offshore and retaining more lakebed sand cover within the system. The existing breakwaters at 255 have not functioned as well as anticipated likely due to the water depth immediately offshore. At the time of original construction of this breakwater system (1999), the offshore water depth (east of the breakwater location) was not surveyed with the level of detail that has been obtained more recently. This water depth allows larger stormwaves to impact the site and erode sand.

The property at 255 N. Mayflower Road has a new revetment that was permitted during the high lake level in 2019 to immediately help reduce erosion to the bluff toe during the record high lake level. The owner was not in a position to wait for an individual permit at the time due to site conditions. Now that the bluff toe has adequate protection, he intends to complete the project to protect the lakebed from further deepening close to shore by breaking waves farther offshore and holding more sand in the bays. The modified plan has been scaled back due to state and federal guidelines/rules and the proposed system will not function as well as it could to help protect the bluff and lakebed due to being only 125' offshore.

Project Description

Beginning at the north end of 261, construct a 55' long breakwater spur to the south. After a 40' gap, reconstruct and extend the gumball into a 140' long quarrystone breakwater extending 100' north of the existing steel groin and 40' south. The breakwaters will have a crest elevation of 586' with an 11' wide crest and slopes of 1:1.5. A steel pier on piles will be constructed over the existing steel groin that is on the property line between 255 and 261. The pier will have a width of 6 feet and a crest of 585'. Once the pier intersects with the breakwater crest there will be a pier deck on open piles over the crest that is 20' long with an extension lakeward to the toe of the breakwater stone for fishing and boat access. There will be stone wave attenuators (serving as toe protection also) along the north side of the pier/groin and on the south side of the southernmost groin with a crest of 586'(N) and 585'(S) and slopes of 1:1. Maintenance will be done in the form of filling voids on the existing south breakwaters. Finally, a steel cap will be installed on the short groin second from the south to groin stability. Per mitigational sandfill requirements, 2,536 cubic yards of clean quarried sand will be placed. New fill will cover 0.17 acres below the visual OHWM. All work will be within 125' of the existing steel seawall.

This permit request includes optional sand nourishment for 10 years in a quantity up to 1500 tons of sand. The sand will only be placed as needed pending site condition – typically based on water level and lake storms.

The proposed system is designed to help retain a sandy beach, move the locus of wave energy further offshore, help reduce lakebed downcutting, reduce erosion of the bluff toe landward of the seawall, and help provide safe access for pedestrians and swimmers to and from Lake Michigan. At most Lake Michigan water levels, there is no access for shore walking south of the project site.

Coastal Geology

This section of coastline has historically lost sand due to lakebed downcutting especially during prolonged periods of low lake levels. Nearshore sand deposits are thin and less than one foot in some locations at this site (Figure 1, Appendix) and scientists estimate that the rate of lakebed erosion up to 6 inches per year (Nairn, 1997). The net result is similar to the effects of global warming and rising sea level on marine coasts. This includes deeper water nearshore, larger stormwaves and progressively narrower beaches as the nearshore lakebed continues to erode.

The Illinois Lake Michigan shoreline is considered "sediment starved" by coastal scientists. This is in contrast to East Coast and Gulf Coast open ocean shores where tens of thousands of tons of sand are found in the nearshore system that provide a primary line of defense against stormwaves. On most Great Lakes shores including southern Lake Michigan, natural sand beaches are not able to protect the lakeshore (exceptions may be during very low lake levels like 1964 or 2013). Large quantities of sand have been trapped or diverted offshore by municipal structures that extend 900 feet or more into the lake. Today, the main sand supply is wave erosion of the nearshore glacial clay lakebed that contains only about 10% sand (Shabica and Pranschke, 1994). The result is that groins are losing their effectiveness at holding a sandy beach during average to high lake levels. To retain a sand covering over the shallow lakebed (where downcutting is most active) as well as to protect the bluff toe, SA has designed this pocket beach system to better hold sand as necessary and protect the lakebed and bluff during variable lake levels.

When beach and nearshore sand is lost, degradation of the nearshore ecosystem will result. Meadows et al., (2005) reports an increase in zebra mussels *Dreissena polymorpha*, and a decrease in native zooplankton in waters where the lakebed is eroding clay and rocks. In comparison, a nearshore area with 100% sand cover supports a species-rich community. The report concludes, "it [is] nonetheless clear that sand-based areas were characterized by sufficient shallow water fish CPUE and species richness to suggest that these are important habitats within the context of the Great Lakes Basin and not simply 'wet deserts' as they are often considered."

Coastal Climate

One of the largest factors in determining the scope of a project is analyzing current lake levels and climatic conditions. Over the past several years, larger-than-normal stormwaves have impacted the shoreline of Lake Michigan due to climate change. The shoreline at 255 and 261 N. Mayflower Road has been impacted by the recent extreme increase in water level evidenced by waves overtopping the existing revetment and the deflation of the beach. These stormwaves, in combination with a severe rebound in Lake Michigan water levels, have exacerbated the nearshore erosion along the lakefront. Changes in weather patterns and lake levels affect the intensity of storms. Unfortunately, it is not possible to predict future Lake Michigan lake levels and how the changing lake levels will impact the shoreline.

The **Illinois State Water Survey, Prairie Research Institute** report on *Potential Impacts of Climate Change on Water Availability* (http://www.isws.illinois.edu/iswsdocs/wsp/climate_impacts_012808.pdf) states that:

> *"Scientists cannot predict future Illinois climatic conditions with confidence. The historical climate and hydrological records since the nineteenth century show that climate has changed significantly in the past and, even without human interference, could change significantly in the future."*

The Illinois State Water Survey goes on to graph future precipitation models, illustrating conditions that are wetter or drier than previous historic extremes. Either scenario is likely to cause loss of property due to stormwave erosion from either lakebed downcutting and/or larger stormwaves. Currently, Lake Michigan water level is hovering around 580' (IGLD 1985).

Benefits of Sandy Beaches

The Great Lakes represent the most important natural resource in the United States. Sandy beaches play an important role in maintaining water quality and safe access. Furthermore, a sandy beach makes a better ecotone (transitional environment) for flora and fauna than seawalls and revetments. Summary arguments supporting a sandy beach system include:

1) Beaches are filters for non-point source runoff.
2) Beaches help reduce lakebed downcutting, a source of fine clay pollutants.
3) Beaches make better wildlife habitat than actively eroding bluffs or seawalls.
4) Stone headlands make better fish habitat than eroding lakebed clay.
5) Beaches protect the lakebed from erosion that causes larger stormwaves to impact the shore.
6) Beaches are far safer for swimmers and boaters than a coast lined with seawalls or revetments, especially in an emergency.

On urban coasts, more than 40 years of system monitoring (Shabica et al, 2011) has shown that engineered pocket beaches (aka bay-beaches or attached-breakwater beaches), pre-nourished with sand, have shown a great resilience to changing lake-levels and decreased sediment-supply. After an intense storm such as the storm on Halloween, 2014, pocket beach recovery can be fast. Further, net sand loss and renourishment costs are lower than for unprotected beaches on open Great Lakes coasts. And finally, a diverse coastal ecosystem dominated by American Beach Grass and native species like Sea-Rocket has been surprising resilient after severe shore erosion events. Planting of native species on the new beaches further improves the decreasing terrestrial habitat regionally. And with each beach, thousands of tons of new sand is brought in, not only to initially nourish the pocket beach but also to add 20% overfill sand to the lakeshore and littoral drift system. Periodic sand re-nourishment has proven to be a successful management tool and provides additional sand for the entire Illinois coastal ecosystem.

Impact to Littoral Drift System

The proposed plan for this site includes enhancement to a breakwater-protected beach system and placement of mitigational sandfill as required for permit. The design of the proposed system, including the mitigational sandfill, will help assure no negative impact to the littoral drift system. This region of the Lake Michigan shoreline around 255 and 261 N. Mayflower Road, Lake Forest is completely engineered. This section of the coastline consists of breakwater-held beaches, groins, seawalls and revetments. Sand mitigation (as required by the IDNR) will be placed in and around the new structures with a 20% overfill as required.

The proposed quarrystone breakwater will extend to 125' offshore from the seawall. The property immediately to the north has a breakwater that extends approximately 170' due to coastal engineering and nearshore water depth, see photo below showing the system immediately to the north as well as this site with the breakwater drawn to scale.

Modified Plan over Google Earth Image

Sandbars easily move around structures built in shallow water (10' or less) as evidenced by Google Earth photos. With the deeper water nearshore, typically the only sandy beaches (during average lake levels) in this area are in locations where engineered structures help to retain the sand. When Forest Park Beach in Lake Forest was constructed, an intensive 5-year monitoring study was completed. According to Chrzastowski and Trask, there are no detrimental effects to downdrift properties. The littoral drift system should remain at a dynamic equilibrium once the mitigational sand is placed in this system (anticipated quantity plus 20% overfill). IDNR regulations for structures that will retain sand require pre- and post-construction surveys, as well as surveys at the one and five-year intervals. This requirement will help assure that a sand equilibrium is met and that the new project is gaining and losing sand at a similar rate to neighboring properties or mitigation may be required at the owner's expense.

Impact on Public Uses

A beach provides a safe place for boaters and swimmers in distress. Fishing will not be impacted negatively, as the underwater area of the quarrystone protection will create an improved fish habitat. Additionally, navigation of water craft will not be impacted, as the proposed construction will not extend further east than the existing nearby structures.

Impact on Natural Resources

Quarrystone structures in the nearshore waters of Lake Michigan and sandy beaches improve native species habitat. The LandOwner Resource Centre with support from the Canadian Wildlife Service and the Ontario

Ministry of Natural Resources states that, "unstable shorelines can release silt that can choke nearby aquatic habitats." Additionally, underwater structures such as artificial reefs constructed of large boulders and clean riprap material "in large water bodies, such as the Great Lakes . . . are often the best method of creating habitat." As stated above, according to Meadows, et al., 2005, "a nearshore area with 100% sand cover support[s] a species rich community." As the design does not impact the bluff and vegetation, the local terrestrial wildlife will continue to inhabit this property.

Type of Permit
We ascertain that the scope of this project requires an Individual Permit.

Description and Schedule of Proposed Activity
This project will be completed via marine construction with a barge and tugboat delivering all materials and equipment to the site. The proposed work will be completed using a backhoe that will work from the beach to place the materials unless the lake level prohibits this method of construction. Work will not begin until all necessary permits have been received. This work will require approximately 12 weeks to complete.

Type and Quantity of Fill/Measures Taken to Avoid Impact/Erosion and Sediment Control Plan
All material will be clean and from inland quarries. Approximately 4,700 tons of clean quarried stone will be placed to construct the breakwater system. Approximately 3,170 tons of clean sand will be placed as sandfill in and around the system. The area of fill to be placed below the Visual Ordinary High Water Mark (583 feet, IGLD 1985) is 0.17 acres.

Summary
All of the described activities and plans will follow IP terms and conditions. All of the proposed work adheres to the guidelines prescribed by the Illinois Environmental Protection Agency and its Anti-Degradation Assessment. U.S. Fish & Wildlife Service will be updated on all relevant correspondence.

If you have any questions, please feel free to call me at the phone number below.

Sincerely,

Jon Shabica
Vice President

C: IDNR/OWR (Casey)
Illinois EPA, Bureau of Water, Permit Section
U.S. Fish & Wildlife Service
David Moore

DESIGN OF SHORELINE EROSION PROTECTION

Introduction

The following report summarizes assumptions and design criteria for a quarrystone breakwater system including sandfill to help retain a beach, provide lake access, and better protect the properties located at 255 and 261 N. Mayflower Road, Lake Forest. The design is based on the drawings included in this submission.

The site lies within a fully engineered section of urban lakeshore that is typically protected with revetments, seawalls, impermeable piers and steel sheetpile groins, as well as large municipal breakwater-held beaches. There are no naturally eroding bluffs in the area.

Evolving Lakeshore Conditions

The Illinois North Shore is sand starved due to primarily large municipal structures (littoral barriers) constructed over the past 100 years that extend offshore past the littoral zone and reduce sand bypass. Research by the Illinois State Geological Survey (1977) and Northeastern Illinois University (Shabica and Pranschke, 1991 and 1994) document that beaches that were 5' to 10' thick in 1975 have thinned to 1' to 3' in the 1990s. Today there is almost no sand moving along this section of coast. Breakwaters constructed 125' offshore or less in the area have been steadily losing their effectiveness at holding beach sand. Physical measurement of Illinois sand deposit location and thickness in the 1990s show a thinning of sand in the nearshore. In addition to a reduction in littoral drift sand caused by littoral barriers and shore armoring, the problem is exacerbated by lakebed erosion. The erosion (downcutting) is most active in the surf zone (6 inches/year reported by Davidson-Arnotte, 1986) in water depths of 3.6' (about 65 feet offshore in areas with a nearshore slope of 1:20) with rates gradually decreasing offshore to a depth of about 15' below 580' (elevation about 565' IGLD85). In most cases the depth of closure will be about 500' to 750' offshore. At the project site, we estimate an annual rate of lakebed erosion of 3 inches to 4 inches per year at the outer edge of the breakwaters. The modified plan has been scaled back due to state and federal guidelines/rules and the proposed system will not function as well as it could to help protect the bluff and lakebed due to being only 125' offshore.

Project Description

The proposed design includes a breakwater protected beach system. The project will include sandfill mitigation that fulfills the design requirements of 20-year stormwave erosion protection. With the higher lake level, stormwaves cause deeper water in the nearshore. The breakwater-protected pocket beach is designed to help maintain the bluff as well as retain and enhance a beach on this property during normal lake conditions.

Summary Specifications

Using the Army Corps of Engineers Shore Protection Manual (1984), performance of nearby prototypes and other sources, the following specifications were developed for this site (elevations are based on IGLD 1985):

Breakwater Specifications	
Lakeward Crest Elevation:	586 ft
Toe of Breakwater:	571 ft
Crest Width:	11 ft
Average Armor Size:	4.5 tons (3-6)
"B" Stone	600 - 1000 lbs
Slope:	1:1.5
Tons/linear ft:	22 tons

Assumptions

• Design High Water (DHW):	583 ft *
• Design Water Level:	581 ft
• Design Low Water (DLW):	577.5 ft *
• Existing clay till elevation at breakwater toe:	570 ft
• 20-yr lakebed erosion at breakwater toe:	3 ft
• Design wave height:	Hs = 9.5' ft
• Nearshore Slope:	1:50
• Design Wave Period (T):	9.9 s **
• Depth at Structure Toe DHW (Ds):	10'
• Design Deepwater Wave (Ho):	18.0'
• Design Wave Length (Lo):	501.8'
• Stone Porosity:	37%

* DHW includes 2 ft storm setup, DLW is equivalent to Low Water Datum
** Resio & Vincent, 1976

Shoreline/Bathymetry

Bathymetric surveying was performed on June 3, 2022. Survey notes: Lake conditions at the time of survey were waves of 1 foot or less. Bathymetric survey was performed using a Trimble R10 GPS Receiver along with a Hydrolite-TM Single Beam Echosounder. Survey was performed tied to Trimble's VRS Now Network, data points were collected in NAV88 datum and converted to IGLD1985.

Water Levels

The following table summarizes water level data representing daily highest extremes measured at Calumet Harbor, Illinois, approximately 45 miles to the south of Glencoe. Note: Low water datum LWD = 577.5 ft (IGLD 1985).

Lake Level	LWD	IGLD 1985
Record High	+5.5	583.0
Record Low	-1.4	576.1

Project Supporting Data

To help facilitate project review, Shabica & Associates offers the following supporting data based on standard coastal engineering practices:

1. **Sediment transport around structure**
   The structure is designed to lie within the surf zone (zone of breaking waves), therefore allowing sediment transport around the structure. The range of breaking wave heights is from 8.3 ft based on a 6-second wave with a wave length of 184 ft (using 1/25 Lo) to 18 ft based on a 9.9-second wave with a wave length of 501.8 ft (Resio and Vincent, 1976). The commonly accepted zone of sediment transport is to 18 ft (depth of closure) in this section of Lake Michigan, which is a function of the design wave parameters. Based on this data, once the structure has been filled with sand, it will continue to bypass littoral drift sand. Survey monitoring will be conducted, as required by the IDNR, to help assure that the system performs as designed.

The IDNR requires sandfill in areas where sediment will be trapped by the new system. Sand volume quantities have been calculated as shown in the permit drawings. As required by the IDNR, a 20% overfill will be added to the calculated volume. Additionally, the new pre- and post-construction monitoring will be performed and submitted to the IDNR to verify the impacts to the system.

2. **Effect on Adjacent Shorelines**
A wave diffraction diagram (Figure 2, Appendix) shows how a shore parallel breakwater reduces wave energy around the breakwater. Using a refracted incident wave angle of 90 degrees (USACE, Shore Protection Manual), with average and design waves, there will be a decrease in wave energy on adjacent properties. The wave diffraction pattern shows that the coefficient of diffraction (K) reduces the wave energy to a distance of about ½ the wave length downdrift and does not have an impact further downdrift. For the average 6-second wave, that distance of reduced wave energy is about 90 ft and for the design wave, the protected distance is about 250 ft. This protected area close to the structure has diminished wave energy that will in turn reduce erosion in the area.

3. **Wave Reduction in Rubble-Mound Structures**
The Iribarren number (ξ), or surf similarity number, is used to determine the wave reflection coefficient. For rubble-mound structures, wave reflection (and wave energy) is reduced by one half or more (0.2 to 0.53) (Figure 3, Appendix). For example, a wave reflection of 0.25 means that the wave energy is reduced by 75%. The range of wave reflection for beaches peaks at about 0.44. The range for plane slopes, however, quickly rises to 0.5 and peaks at .91. This illustrates that rubble-mound structures reduce wave energy almost as well as beaches.

Lakebed Erosion

Lakebed erosion, active in water depths of 10 ft or less, is a design component of this plan. This section of the Lake Forest lakeshore is considered sediment starved. Sand deposits were measured at this site (255 N. Mayflower Road, Lake Forest) from the backshore to a depth of 6.7 m (22 ft). Nearshore sand deposits averaged two to three feet thick from shore to 100 feet offshore and thinned to 0 feet thickness from 137 to 270 feet, reaching a two-foot thickness at 500 feet offshore. At 750 feet offshore, no sand was present through the end of the transect (Shabica & Pranschke, 1994). Also, the site is underlain by highly-erodable, cohesive glacial clay-till. See Shabica survey data and cross-section showing loss of lakebed sand from 1975 to 1989. Calculated sand deposits at this site are 81.2 cubic meters per meter of lakeshore to a depth of 4 meters. According to Robert Nairn, approximately 200 m^3 of sand cover per meter of lakeshore (out to a depth of 4 m) is necessary to protect the underlying cohesive profile from lakebed erosion under most conditions. Sand and coarser sediments represent typically less than 15% of the material eroding from the lakebed and bluffs.

Using the historic rate of lakebed downcutting of 0.15 ft/yr (Nairn, 1997), an irreversible lowering of the nearshore lakebed clay of approximately 3.0 ft over a 20-year period is predicted in unprotected areas. With the stone breakwater, revetment and sandfill installed, the lakebed erosion will be reduced.

Stone Stability, Armorstone

The proposed quarrystone breakwater has two layers of 3 – 6 ton armorstone built on a 1:1.5 slope. Overtopping of the structure is expected during storms and higher water levels. Design conditions include:

* Lakeward breakwater crest elevation 3 ft above DHW, 7.5 ft above DLW
* Depth-limited breaking waves will break on the stone breakwater and sand beach
* Depth at the toe of the structure is 7 ft (576.0) at design high water
* Incident wave directions: NE, E and SE
* Wave period for DHW T = 9.9 seconds
* Wave period for average conditions T = 6 seconds

Quartzite armorstone is recommended as it is highly durable and is locally available in most gradations under 6 tons. Hudson's formula, along with prototype experience, was used to estimate armorstone size. An armorstone of 5.5 tons is predicted for 2-layer random placement armorstone based on Hudson's Formula. Based on study of prototype performance of similar structures in this region, our recommendation is to use 3 – 6 ton armorstone that is locked together during placement. The armorstone gradation selected for this project is 3 – 6 tons.

Project Monitoring

As the performance of shore protection structures cannot be predicted with absolute certainty, the shore protection system for 255 and 261 N. Mayflower Road, Lake Forest will be inspected as required by IDNR guidelines. This includes topographic and hydrographic surveys beginning at an elevation of 581.5 feet (IGLD 1985) and progressing to 300 feet lakeward of the lakeward end of the project within the north and south property lines. Additionally, all structures should be inspected to assure that they continue to meet design specifications.

2021 Google Earth – Approximate property lines in yellow

2022 SA Photo – Shows existing condition with lack of sand in the bay

References

Anglin, C.D., and K. J. Macintosh, *Southport Marina, Kenosha, Wisconsin: Design and Construction of Breakwaters, in Coastal Engineering for the Great Lakes*, a short course, University of Wisconsin, March 11-13, 1991.

W.F Baird & Associates and Warzyn Engineering, 1986, *Shoreline Development at Forest Park, Lake Forest, Illinois, Model Studies*, Unpublished Final Report to the City of Lake Forest.

Chrzastowski, M.J. and C.B. Trask, 1995, Illinois State Geological Survey, Open File Series, 1996-7, 57 p. plus eight appendices.

Chrzastowski, M.J. and C.B. Trask, 1996, *Review of the City of Lake Forest Final Report for the 1995 beach and nearshore monitoring program, Forest Park Beach, Lake Forest, Illinois*: Illinois State Geological Survey, Open File Series, 1996-6, 57 p. plus eight appendices.

Chrzastowski, M.J., 2005, *Chicagoland Geology and the Making of a Metropolis*, Illinois State Geological Survey Open File Series OFS 2005-9.

Davidson-Arnotte, 2005, *Rates of Erosion of Till in the Nearshore Zone. Earth Surface Processes and Landforms 11*: pp 53-88

Johnson, Charles, 1997, USACE, Chicago, personal communication.

LandOwner Resource Centre, Canadian Wildlife Service, Ontario Ministry of Natural Resources, 1999, *Improving Fish Habitat,* Extension Notes: Ontario, LRC 45.

Meadows, Guy; Mackay, S.; Goforth, R.; Mickelson, D.; Edil, T.; Fuller, J.; Guy, D.; Meadows, L.; Brown, E.; Carman, S.; Liebenthal, D.; 2005, *Cumulative Habitat Impacts of Nearshore Engineering,* Journal of Great Lakes Research; vol.31, Supplement 1, 2005, pp.90-112.

Nairn, Robert B. 1997, *Cohesive Shores,* Shore & Beach Vol. 65 No. 2: 17-21.

Norby, R.D., and Collinson, C., 1977, *Sedimentary Characteristics of the Lake Michigan Nearshore Bottom in Illinois. ICZM Program Extended Work Product Map*, Illinois State Geologic Survey, Champaign, Illinois.

Resio, Donald T. and Charles L. Vincent, 1976, *Design Wave Information For The Great Lakes: Technical Report 3, Lake Michigan*.

Shabica, C.W., F. Pranschke and M. Chrzastowski. 1991, *Survey of Littoral Drift Sand deposits Along the Illinois Shore of Michigan from Fort Sheridan to Evanston*, Illinois/Indiana Sea Grant Program, IL-IN-SG-R-91-3.

Shabica, C.W., F. Pranschke, 1994, *Survey of Littoral Drift Sand Deposits Along the Illinois and Indiana Shores of Lake Michigan*, U.S. Geological Survey Symposium Volume, Journal of Great Lakes Research, vol. 20, no.1, pp 61-72.

Shabica, Charles and Assoc., 1997, *Lake Bluff Beach Monitoring and Mitigation Report 5*, US Army Corps of Engineers, Chicago District.

US Army Corps of Engineers, 1984, *Shore Protection Manual*, Coastal Engineering Research Center, Vicksburg, Mississippi.

FIGURE 1a

Lake Forest - 255 N Mayflower 08/27/ Date:08/27/91 Time:

Enter lake surface 578.58 elevation for time of survey

Enter Graph: DATA A DATA B DATA C

Enter Dist. From Shore	Enter Water Depth	Enter Sand Thick ness	Top of Sand Elev. 1990	Bottom of Sand Elev. 1990	Enter Sand Thick. 1975	Top of sand 1975	Enter Hard- pan Type	Sand Volume Cu.Yd. Per ft. 1975	1990
-16.0	-1.3	0.0	579.9	579.9		579.9		0.0	0.0
0.0	0.0	2.5	578.6	576.1		576.1		0.0	1.9
25.0	3.0	2.5	575.6	573.1		573.1		0.0	2.3
50.0	4.0	2.5	574.6	572.1		572.1		0.0	3.5
100.0	6.0	2.5	572.6	570.1		570.1		0.0	4.0
137.0	8.0	0.0	570.6	570.6		570.6	rocks &	0.0	0.0
270.0	10.0	0.0	568.6	568.6		568.6	clay	0.0	0.0
498.0	11.0	2.0	567.6	565.6		565.6		0.0	17.9
752.0	13.0	0.0	565.6	565.6		565.6		0.0	0.0
985.0	15.0	0.0	563.6	563.6		563.6	rock & cl	0.0	0.0
1240.0	16.0	0.0	562.6	562.6		562.6	rock & cl	0.0	0.0
1483.0	17.0	0.0	561.6	561.6		561.6	rock & cl	0.0	0.0
1735.0	19.0	0.0	559.6	559.6		559.6	rock & cl	0.0	0.0
1979.0	20.0	0.0	558.6	558.6		558.6	rock & cl	0.0	0.0
2250.0			578.6	578.6		578.6		0.0	0.0
0.0			578.6	578.6		578.6		0.0	0.0
0.0									
							TOTAL	0.0 CuYd/ft 1975	29.6 CuYd/ft 1990

Note all measurements in feet

Field Worksheet from 1991 USGS Lakefront Sand Thickness Survey at 255 N. Mayflower, Lake Forest (Shabica et al., 1991)

FIGURE 1b

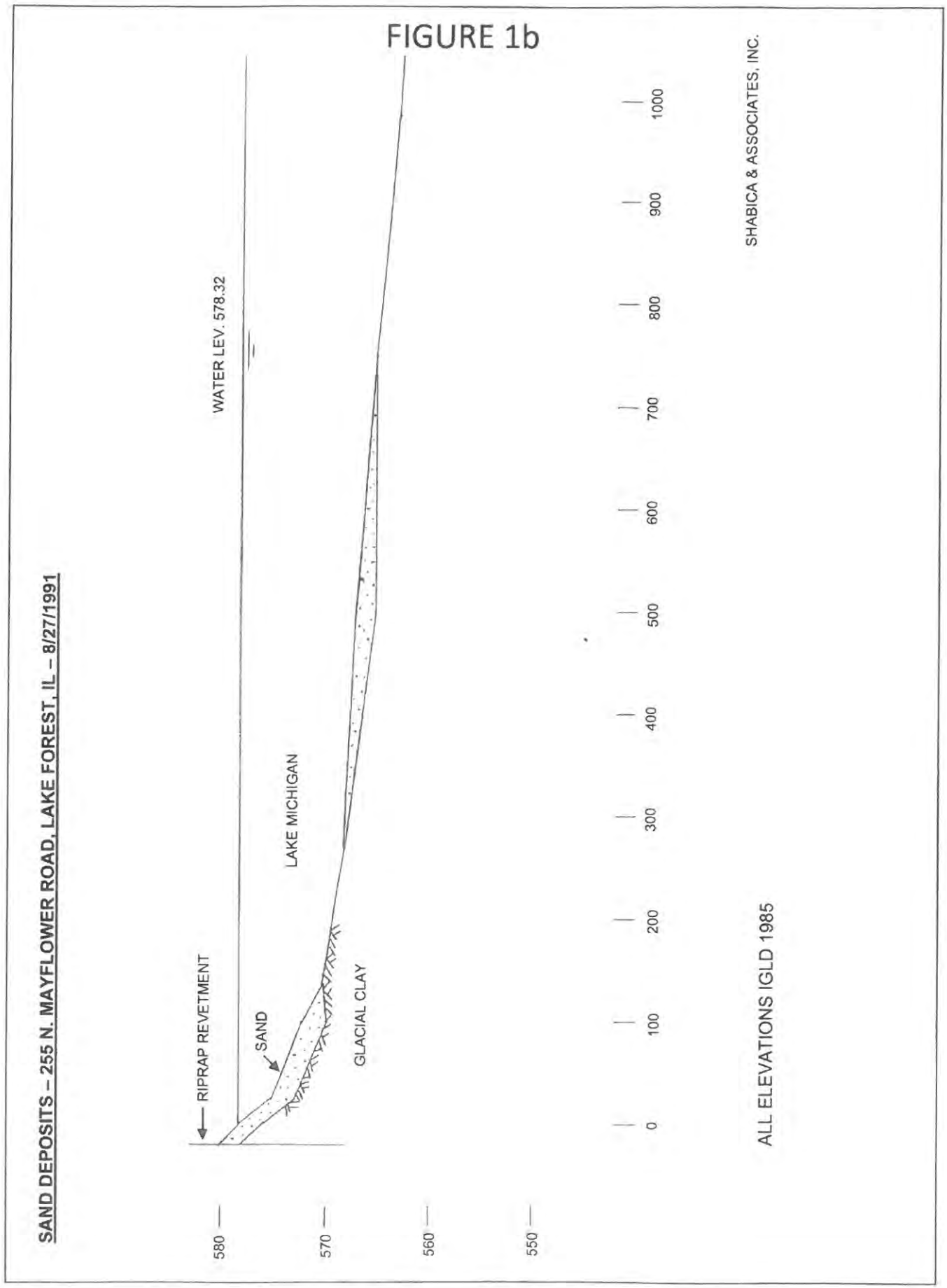
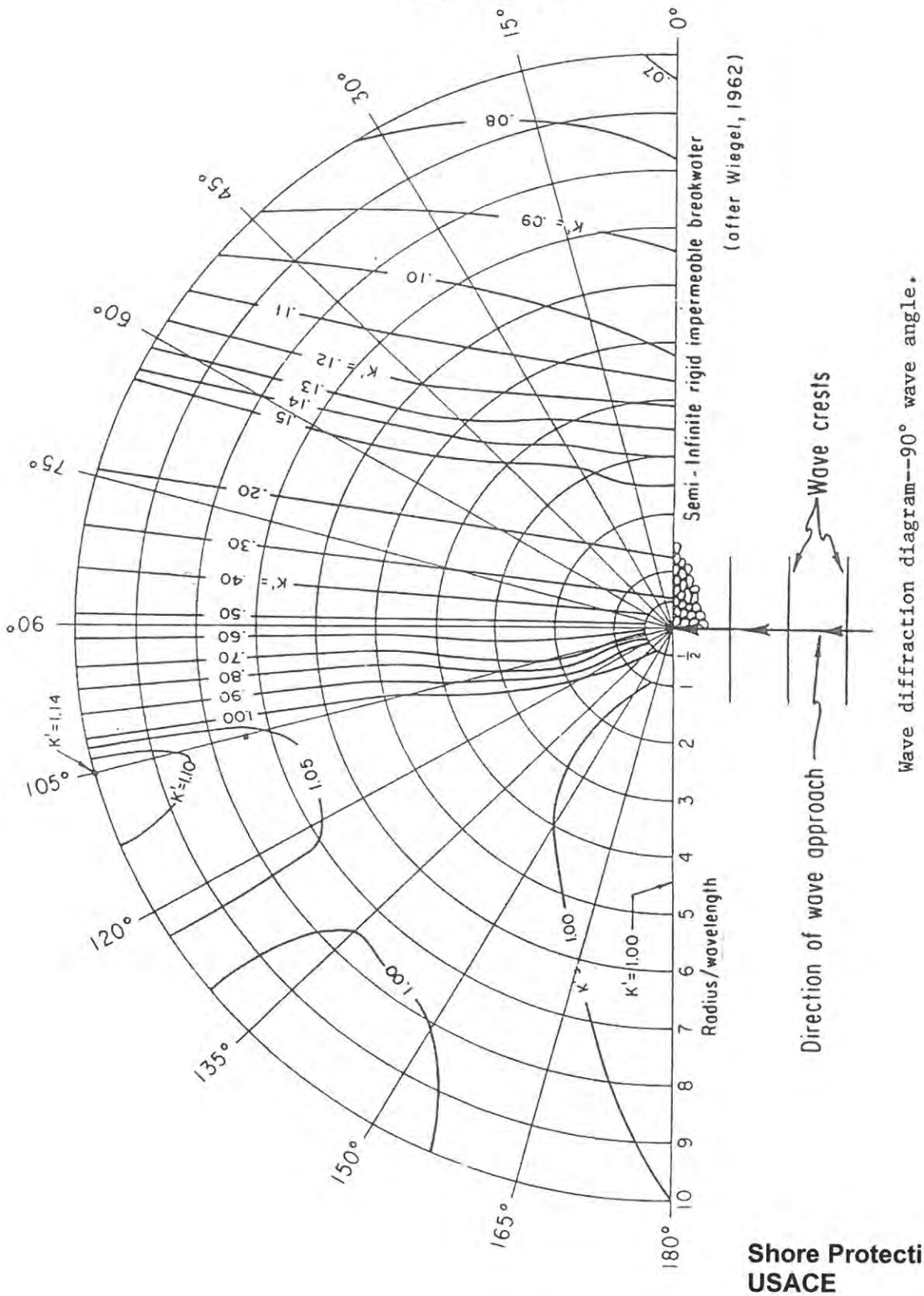
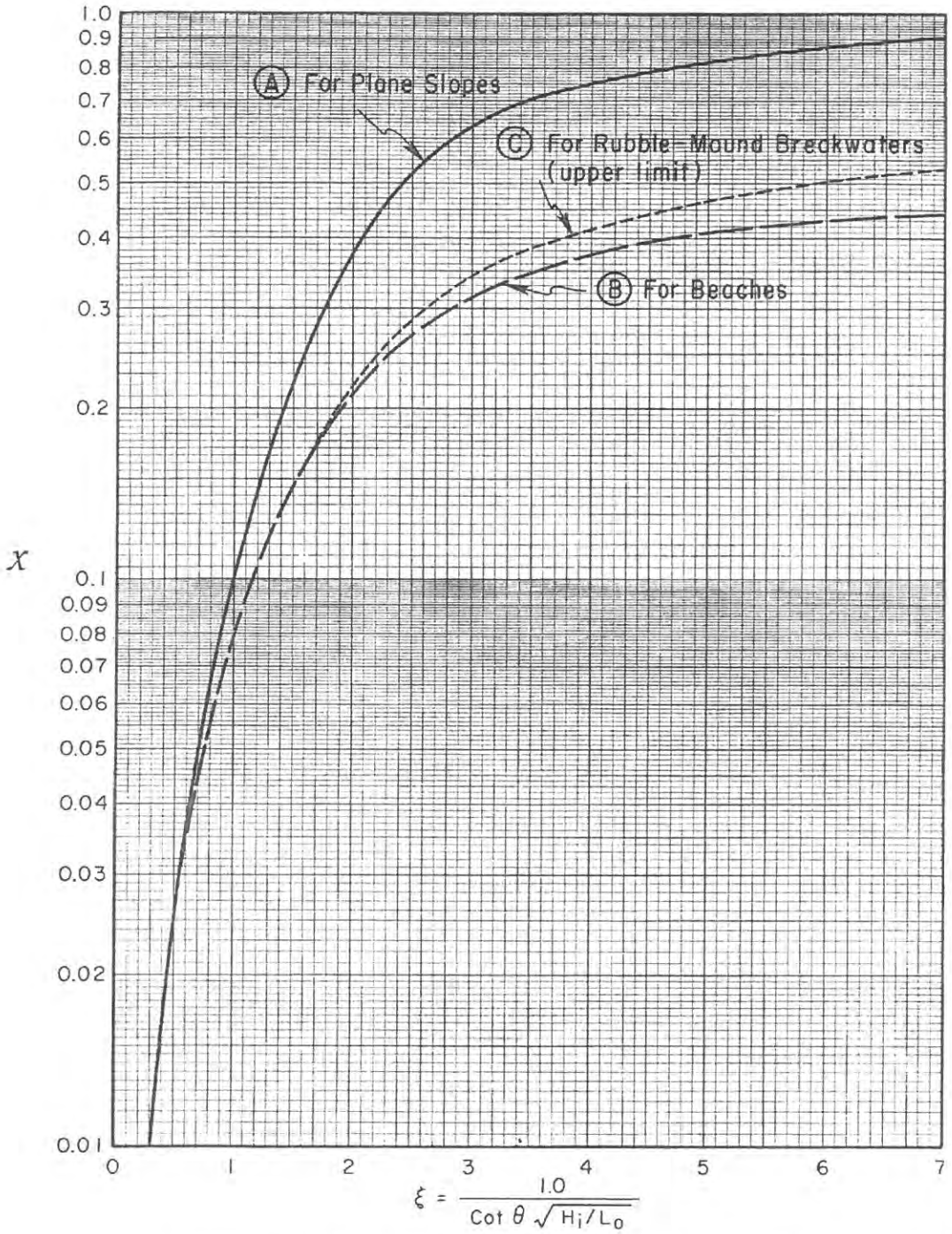

SAND DEPOSITS – 255 N. MAYFLOWER ROAD, LAKE FOREST, IL – 8/27/1991
WATER LEV. 578.32
LAKE MICHIGAN
RIPRAP REVETMENT
SAND
GLACIAL CLAY
580
570
560
550
0
100
200
300
400
500
600
700
800
900
1000
ALL ELEVATIONS IGLD 1985
SHABICA & ASSOCIATES, INC.

FIGURE 2



Shore Protection Manual
USACE

FIGURE 3



Wave reflection coefficients for slopes, beaches, and rubble-mound breakwaters as a function of the surf similarity parameter ξ .

Shore Protection Manual
USACE

JOINT APPLICATION FORM FOR ILLINOIS

ITEMS 1 AND 2 FOR AGENCY USE

1. Application Number	2. Date Received

3. and 4. (SEE SPECIAL INSTRUCTIONS) NAME, MAILING ADDRESS AND TELEPHONE NUMBERS

3a. Applicant's Name:	3b. Co-Applicant/Property Owner Name (if needed or if different from applicant):	4. Authorized Agent (an agent is not required):
David Moore Company Name (if any): Address: 255 N. Mayflower Road Lake Forest, IL 60045 Email Address:	Company Name (if any): Address: Email Address:	Jon Shabica Company Name (if any): Shabica & Associates Address: 550 Frontage Road Suite 3735 Northfield, IL 60093 Email Address:
Applicant's Phone Nos. w/area code Business: Residence: Cell: Fax:	Applicant's Phone Nos. w/area code Business: Residence: Cell: Fax:	Agent's Phone Nos. w/area code Business: Residence: Cell: Fax:

STATEMENT OF AUTHORIZATION

I hereby authorize, Shabica & Associates to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this [illegible]ation.

Applicant's Signature _____ Date 1-25-2024

5. ADJOINING PROPERTY OWNERS (Upstream and Downstream of the water body and within Visual Reach of Project)

Name	Mailing Address	Phone No. w/area code
a. see attached list b. c. d.		

6. PROJECT TITLE:
Breakwater-Protected Beach and Sand Nourishment

7. PROJECT LOCATION:
Lakefront at 261 and 255 N. Mayflower Road, Lake Forest, Illinois

LATITUDE: 42.24388 °N LONGITUDE: -87.81658 °W	UTMs Northing: 4677178.14 Easting: 16T432631.85				
STREET, ROAD, OR OTHER DESCRIPTIVE LOCATION Lakefront at 261 and 255 N. Mayflower Road	LEGAL DESCRIPT	QUARTER SE	SECTION 34	TOWNSHIP NO. 44N	RANGE 12E
☒ IN OR ☐ NEAR CITY OF TOWN (check appropriate box) Municipality Name Lake Forest	WATERWAY Lake Michigan			RIVER MILE (if applicable)	
COUNTY Lake	STATE IL	ZIP CODE 60045			

Revised 2010

☐ Corps of Engineers ☐ IL Dep't of Natural Resources ☐ IL Environmental Protection Agency ☐ Applicant's Copy

8. PROJECT DESCRIPTION (Include all features):

Beginning at the north end of 261, construct a 55' long breakwater spur to the south. After a 40' gap, reconstruct and extend the gumball into a 140' long quarrystone breakwater extending 100' north of the existing steel groin and 40' south. The breakwaters will have a crest elevation of 586' with an 11' wide crest and slopes of 1:1.5. A steel pier on piles will be constructed over the existing steel groin that is on the property line between 255 and 261. The pier will have a width of 6 feet and a crest of 585'. Once the pier intersects with the breakwater crest there will be a pier deck on open piles over the crest that is 20' long with an extension lakeward to the toe of the breakwater stone for fishing and boat access. There will be stone wave attenuators (serving as toe protection also) along the north side of the pier/groin and on the south side of the southernmost groin with a crest of 586'(N) and 585'(S) and slopes of 1:1. Maintenance will be done in the form of filling voids on the existing south breakwaters. Finally, a steel cap will be installed on the short groin second from the south to groin stability. Per mitigational sandfill requirements, 2,536 cubic yards of clean quarried sand will be placed. New fill will cover 0.17 acres below the visual OHWM. All work will be within 125' of the existing steel seawall.

This permit request includes optional sand nourishment for 10 years in a quantity up to 1500 tons of sand. The sand will only be placed as needed pending site condition – typically based on water level and lake storms.

9. PURPOSE AND NEED OF PROJECT:

Shore protection and to help reduce deepening of the lakebed near shore.

COMPLETE THE FOLLOWING FOUR BLOCKS IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

10. REASON(S) FOR DISCHARGE:

To help reduce wave energy and related erosion for shore protection

11. TYPE(S) OF MATERIAL BEING DISCHARGED AND THE AMOUNT OF EACH TYPE IN CUBIC YARDS FOR WATERWAYS:

TYPE: Stone/Sand

AMOUNT IN CUBIC YARDS:

1,765 cu yds/2,536 cu yds

12. SURFACE AREA IN ACRES OF WETLANDS OR OTHER WATERS FILLED (See Instructions)

0.17

13. DESCRIPTION OF AVOIDANCE, MINIMIZATION AND COMPENSATION (See instructions)

This project will not negatively impact the local terrestrial and aquatic flora and fauna. The breakwater and beach will improve habitat. The project will not negatively impact the littoral drift stream.

14. Date activity is proposed to commence: August 15, 2024

Date activity is expected to be completed: 15 weeks after project commencement

15. Is any portion of the activity for which authorization is sought now complete? Yes [ ] No [X]

NOTE: If answer is "YES" give reasons in the Project Description and Remarks section. Indicate the existing work on drawings.

Month and Year the activity was completed

16. List all approvals or certification and denials received from other Federal, interstate, state, or local agencies for structures, construction, discharges or other activities described in this application.

Issuing Agency	Type of Approval	Identification No.	Date of Application	Date of Approval	Date of Denial

17. CONSENT TO ENTER PROPERTY LISTED IN PART 7 ABOVE IS HEREBY GRANTED. Yes No

18. APPLICATION VERIFICATION (SEE SPECIAL INSTRUCTIONS)

Application is hereby made for the activities described herein. I certify that I am familiar with the information contained in the application, and that to the best of my knowledge and belief, such information is true, complete, and accurate. I further certify that I possess the authority to undertake the proposed activities.

2-12-2024
Date

Signature of Applicant or Authorized Agent — Date

Signature of Applicant or Authorized Agent — Date

☐ Corps of Engineers Revised 2010 ☐ IL Dep't of Natural Resources ☐ IL Environmental Protection Agency ☐ Applicant's Copy

SEE INSTRUCTIONS FOR ADDRESS

Vicinity Map

Breakwater-Protected Beach
and Sand Nourishment

255 and 261 N. Mayflower Road
Lake Forest, IL 60045

Shabica & Associates, Inc.

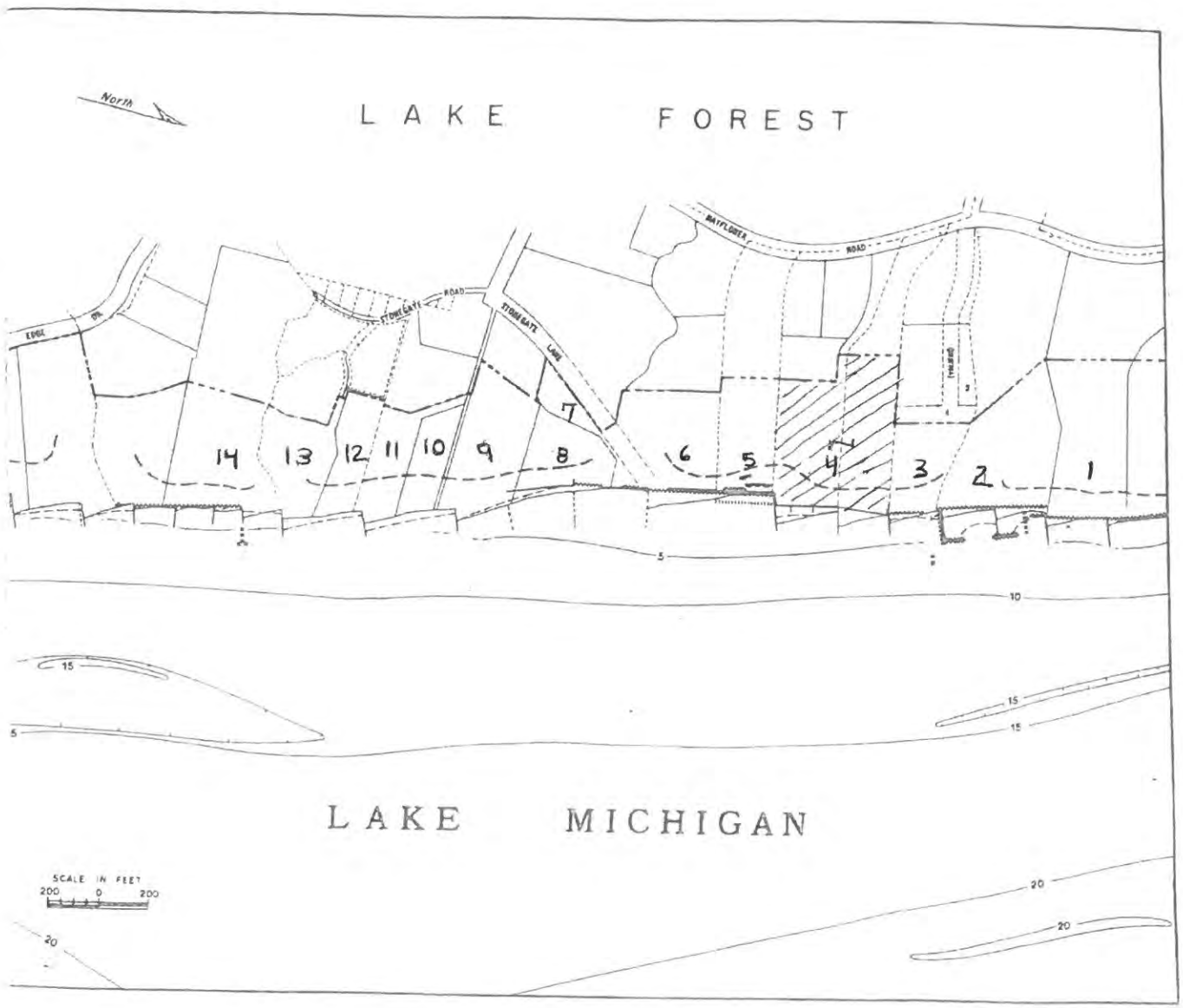
Location of Project: 255 and 261 N. Mayflower Road, Lake Forest, IL 60045

List of property owners (from North to South):

1. CTLTC TTEE TR#8002383831 DTD 8/18/20,
2. Bernadette Haas,
3. Vista Del Lago LLC,

4. Subject Property: David Moore,
5. Charles R. Walgreen, III,
6. Trust #8174,
7. Graham D. and Beth A. Cook,
8. Thomas and Connie Duckworth,
9. WES JH LOT 76 LLC,
10. Chicago Title Land & Trust,
11. Michael Tracy,
12. Jack Dempsey,
13. Susan Svigos Revocable Trust,
14. John N. Kapoor 1999 Descendants Trust,

550 Frontage Road • Suite 3735 • Northfield, Illinois 60093 • Tel 847.446.1436 • info@shabica.com
www.shabica.com



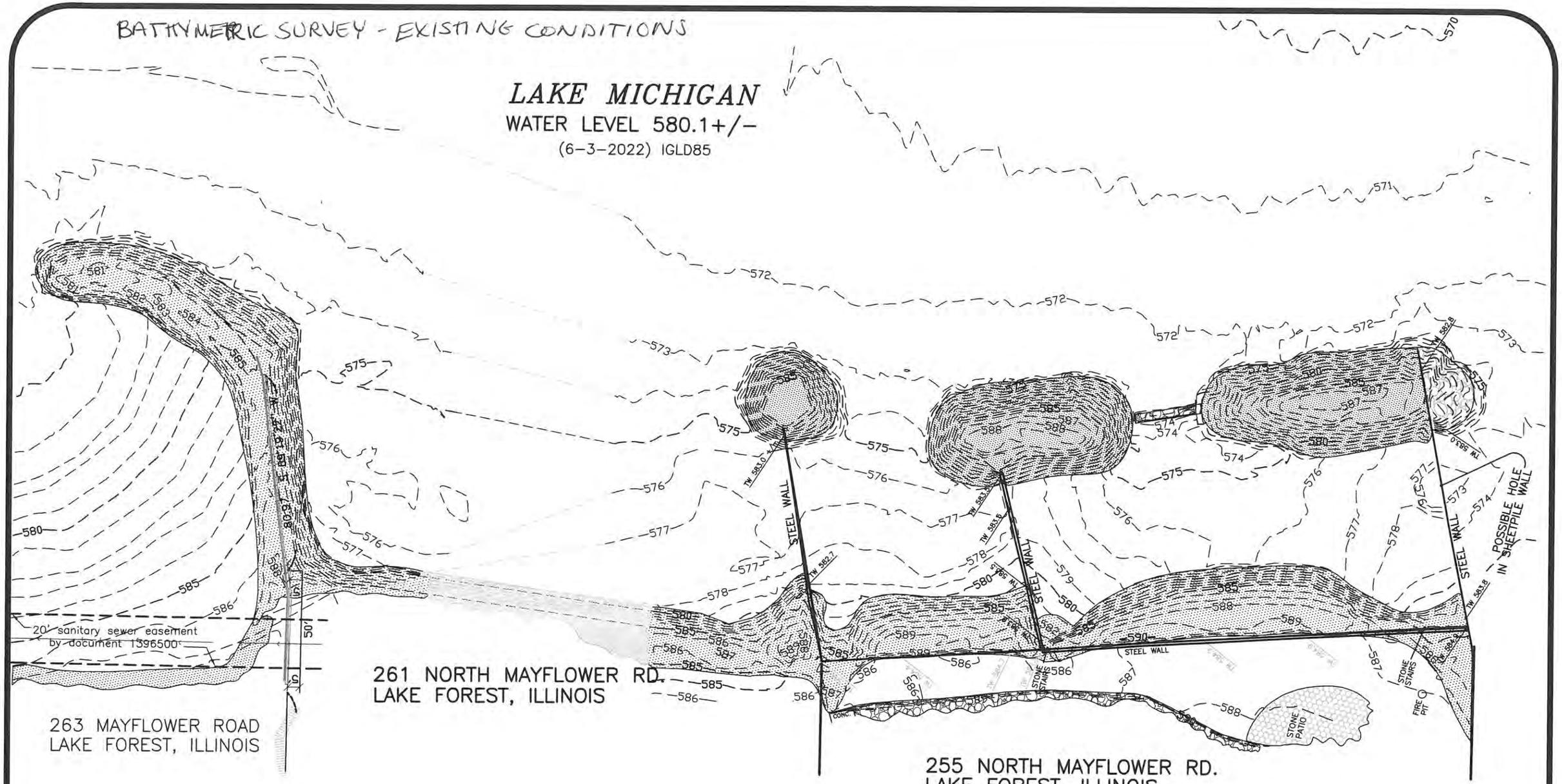
LOCATION MAP

BATHYMETRIC SURVEY - EXISTING CONDITIONS

LAKE MICHIGAN

WATER LEVEL 580.1+/-

(6-3-2022) IGLD85



GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)

1 inch = 40 ft.

SCALE: 1" = 40'

PLAN VIEW OVER BATHYMETRY

LAKE MICHIGAN

WATER LEVEL 580.1+/-

(6-3-2022) IGLD85

PROPOSED BREAKWATERS

125' OFFSHORE

MAINTENANCE TO BREAKWATERS
FILL VOIDS AS NECESSARY

CREST 586'

CREST 586'

SANDFILL AREA

OHWM 581.5
(ABSENCE OF INDICATORS FOR VISUAL OHWM)

PIER ON PILES @ 585'

125'

ADD STEEL CAP

SANDFILL AREA

SAND NOURISHMENT AREA

SAND @ 580'

SAND @ 580'

BEACH

STEEL WALL

STEEL WALL

STEEL WALL

POSSIBLE HOLE IN SHEETPILE WALL

STONE STAIRS

FIRE PIT

STONE STEPS

20' sanitary sewer easement by document 1396500

261 NORTH MAYFLOWER RD.
LAKE FOREST, ILLINOIS

263 MAYFLOWER ROAD
LAKE FOREST, ILLINOIS

255 NORTH MAYFLOWER RD.
LAKE FOREST, ILLINOIS

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)

1 inch = 40 ft.

SCALE: 1" = 40'

PLAN VIEW

Shabica & Associates, Inc.
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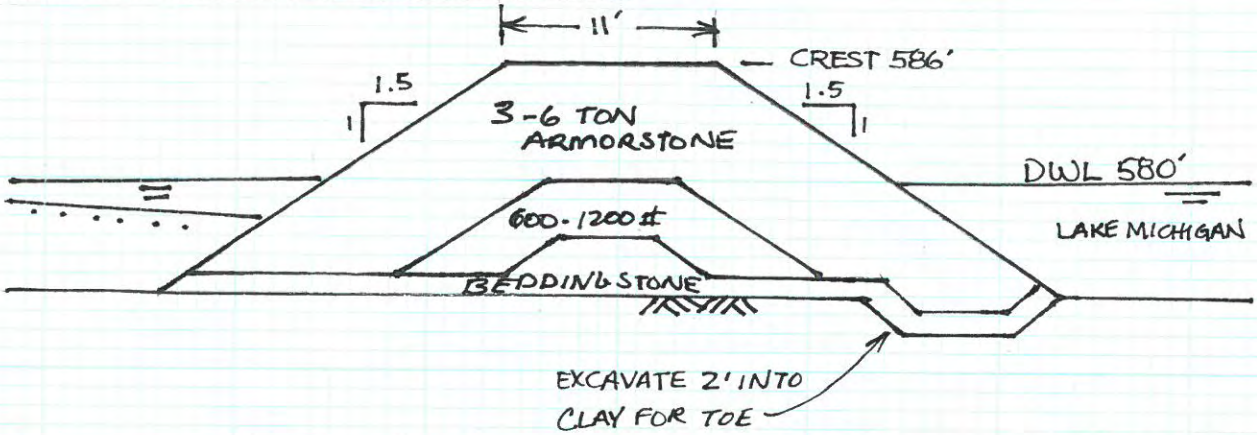
Northfield, Illinois 60093

FEB. 6, 2024

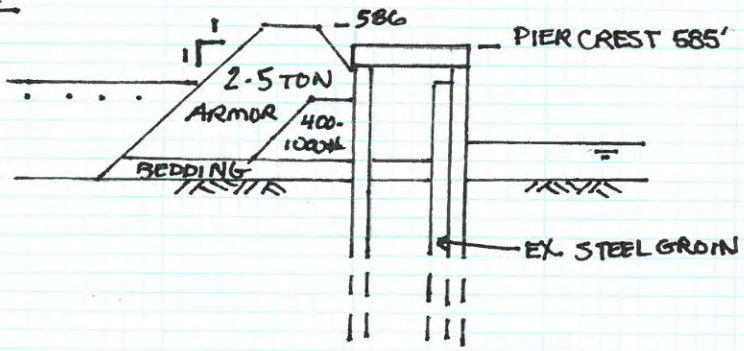
MOD. FEB. 13, 2024

CROSS SECTIONS

BREAKWATER CROSS SECTION TYPICAL

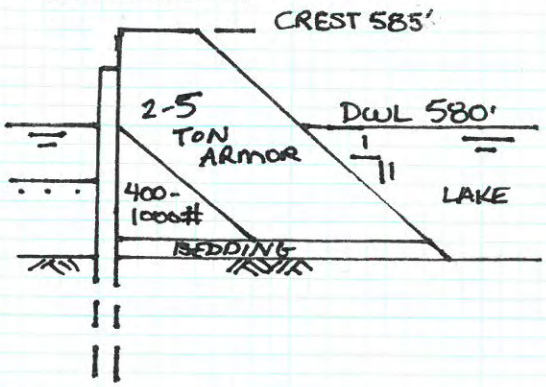


CENTRAL PIER W/TOESTONE

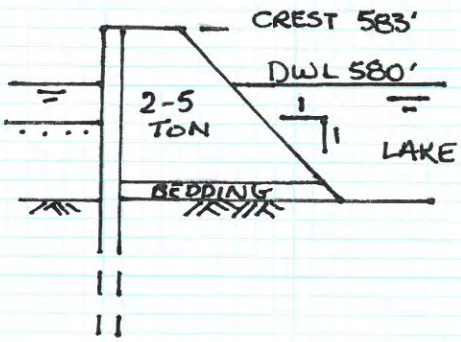


SOUTH GROIN TOESTONE

SECTION A-A



SECTION B-B



0 FEET 10

SCALE

DATUM: IGLD 1985

TOLERANCE ± 1'

CROSS SECTIONS

255 MAYFLOWER, LF

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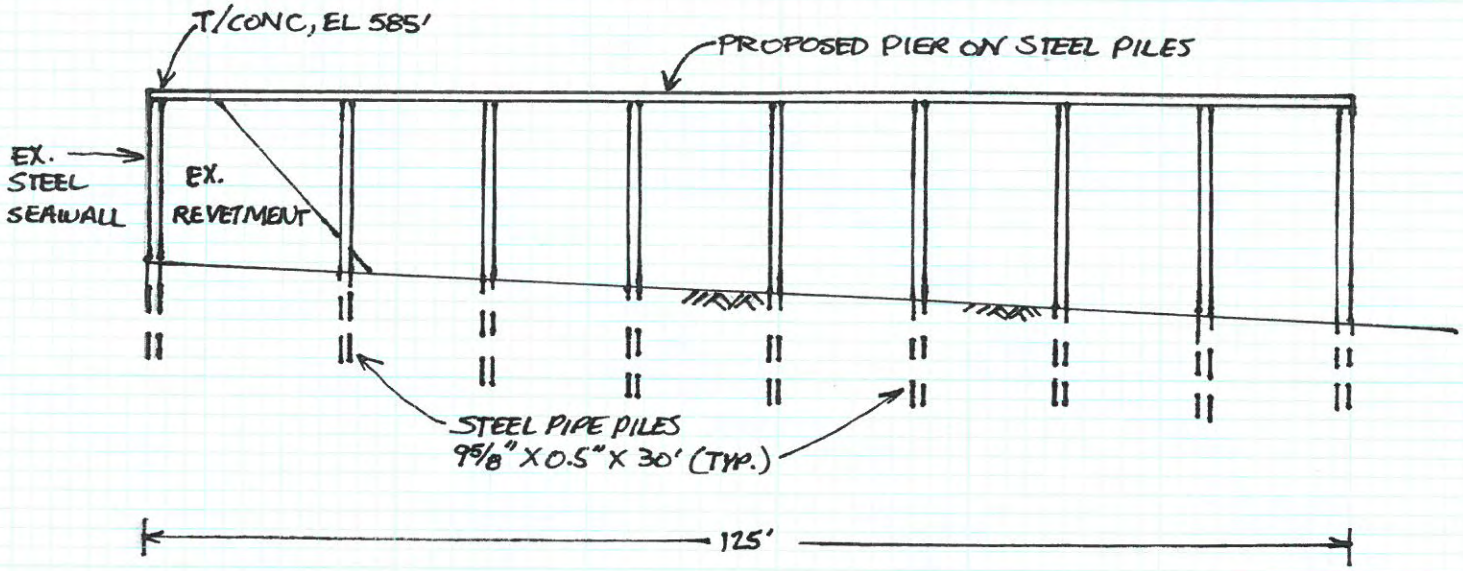
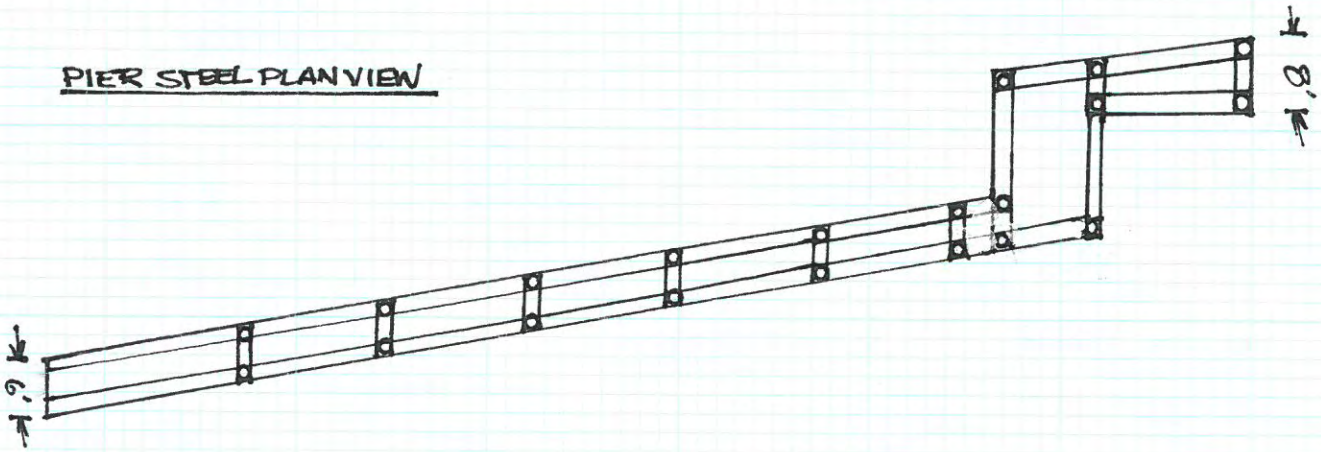
FEB. 6, 2024

PIER CROSS SECTION



PIER STEEL PLAN VIEW



0 FEET 20
SCALE

DATUM: IGLD 1985

PIER DETAILS

255 MAYFLOWER, LF

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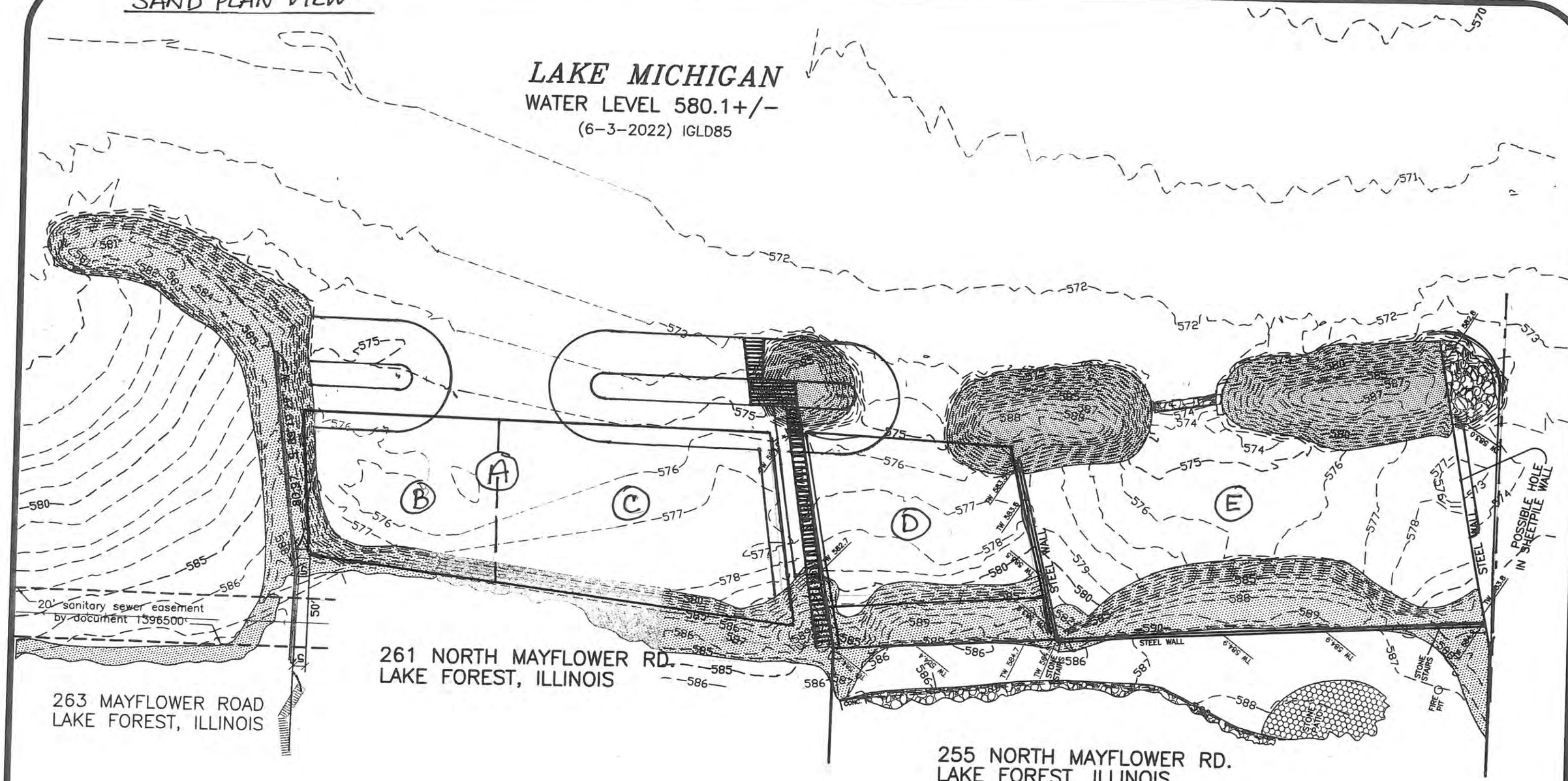
FEB. 6, 2024

SAND PLAN VIEW

LAKE MICHIGAN

WATER LEVEL 580.1+/-

(6-3-2022) IGLD85



263 MAYFLOWER ROAD
LAKE FOREST, ILLINOIS

261 NORTH MAYFLOWER RD.
LAKE FOREST, ILLINOIS

255 NORTH MAYFLOWER RD.
LAKE FOREST, ILLINOIS

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)

1 inch = 40 ft.

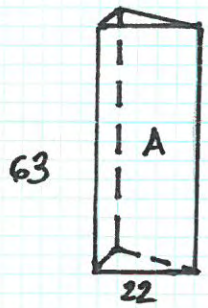
SCALE: 1" = 40'

SAND PLAN VIEW

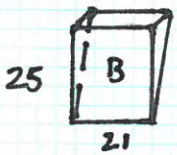
Shabica & Associates, Inc.
550 Frontage Rd, Suite 3735
Northfield, Illinois 60093

FEB. 6, 2024

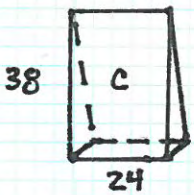
SAND CALCULATIONS



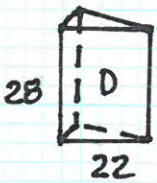
$$\frac{63 \times 22 \times 1.5}{2} = 1{,}023 \text{ cu. yds.}$$



$$\frac{25 \times 21 \times .67}{2} = 176 \text{ cu. yds.}$$



$$\frac{38 \times 24 \times 1.33}{2} = 606 \text{ cu. yds.}$$



$$\frac{22 \times 28 \times 1}{2} = 308 \text{ cu. yds.}$$

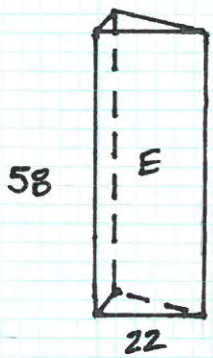
1,023 + 176 + 606 + 308 = 2,113 cu. yds.

2,113 cu. yds x 20% OVERFILL = 423 cu. yds.

2,113 cu yds. + 423 cu. yds. = 2,536 cu. yds.

2,536 cu. yds. x 1.25 yds./TON = 3,170 TONS

PLACE 3,170 TONS OF CLEAN SAND



AREA E IS FOR SAND NOURISHMENT ONLY, NOT INCLUDED IN THE MONITORED AREA.

A-E DISTANCES IN YARDS

SAND CALCS

255 MAYFLOWER, LF

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Northfield, Illinois 60093

FEB. 6, 2024