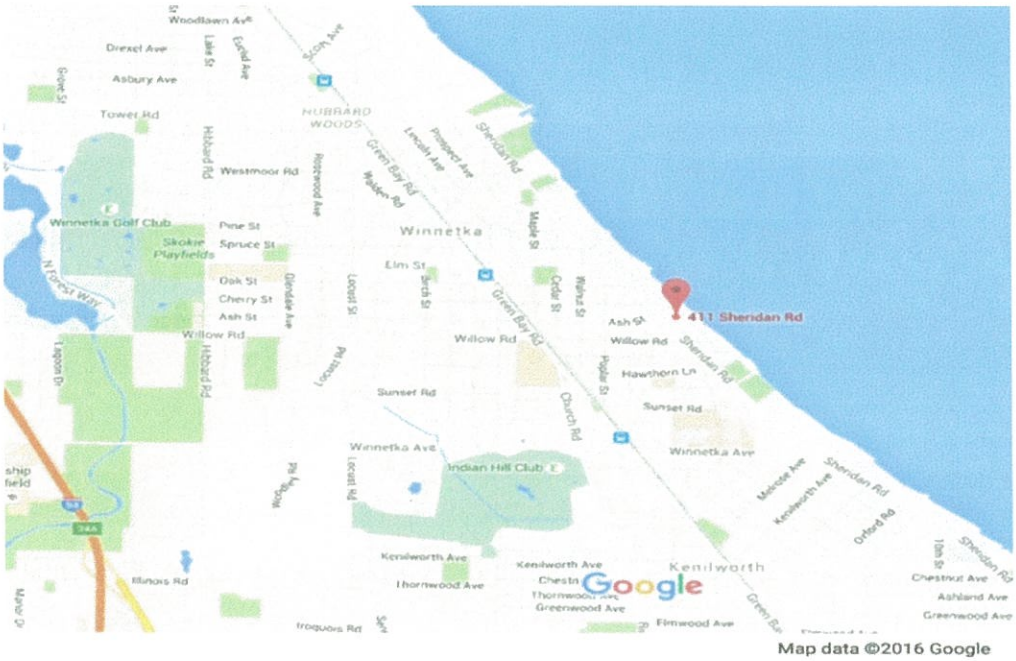
Shabica & Associates, Inc.
WE BUILD BEACHES

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: January 19, 2016

In compliance with the Illinois Coastal Management Federal Consistency Review Procedures, we provide the following information for a proposed quarrystone breakwater-protected beach and sand nourishment for the properties located at 391 and 411 Sheridan Road, Winnetka, Illinois 60093, owned by Mr. Michael Hara.

Location of Project
The proposed quarrystone breakwater-protected beach will be built on the lakefront of the properties located at 391 and 411 Sheridan Road, Winnetka, Illinois 60093, owned by Mr. Michael Hara.



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 1, 2016. This work will require approximately 14 weeks to complete.

Extent of Work to be Conducted

The shoreline stabilization will be comprised of installing quarrystone breakwaters that are connected to existing structures (or proposed structures already under review at 419 Sheridan) to create a cohesive bay beach system with revetments prudently located. No new work will be done further than 125' east of the bluff toe per IDNR guidelines. The project includes removal of several previously designed structures that are oddly located and in some cases impede access to Lake Michigan. Beginning at the north, a breakwater spur will be constructed extending southeast from the currently proposed breakwater at 419 Sheridan. This breakwater will have a crest of 583' and slopes of 1:1.5. Sections of quarrystone revetment will be constructed lakeward of the easternmost retaining walls as necessary for shore protection. Revetment crests will be up to the elevation of the retaining walls not to exceed 588' with a slope of 1:1. A quarrystone breakwater will be constructed extending north and south from the existing steel groin between the 391 and 411 lots. This breakwater will be 114' long (52' north and 62' south from the steel groin to the toe stone). The breakwater crest will be 584' with slopes of 1:1.5. Three structures on the 391 lot will be removed: the north breakwater, the concrete modular structures and the pile of armorstone in the middle of the beach that hold a perched beach. The south breakwater that extends north from the existing pier will be shortened and maintained. This structure does extend beyond 125' east from the shoreline, but its length will be reduced and the structure maintained to provide long-term stability. The crest will be reduced from a high of 588.5' to 586' tapering to 584' with slopes of 1:1.5. The revetment on the 391 lot will be maintained as necessary simply to fill void spaces and provide long-term stability. Approximately 2,962 cu. yds of clean sand will be placed as required by the IDNR.

The proposed system is designed to help retain the sandy beach, move the locus of wave energy further offshore, help reduce lakebed downcutting, and provide safe access for pedestrians to Lake Michigan.

The sand nourishment is for placement of up to 1,000 tons annually. Pending lake levels and beach conditions, sand placement will be completed as necessary to replenish sand lost to the system over time.

Contact Information

All questions pertaining to this project can be submitted to:

Jon Shabica
Shabica & Associates, Inc.
550 Frontage Road, Suite 3735
Northfield, IL 60093
jon@shabica.com
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

2015 Google Earth Photo; see approximate property lines

2015 North beach cell with narrow beach during lake levels 1 ft over LWD. During even small lake storms, the concrete structures are vulnerable to wave attack and undermining.

2015 South beach cell with cobble beach. Concrete modular structures inhibit pedestrian access to the lake. Stone pile in the center of the beach (right side of photograph) hold a perched beach landward.

Shabica & Associates, Inc.
WE BUILD BEACHES

Ms. Kathy Chernich
East Section Chief, Regulatory Branch
Chicago District
U.S. Army Corps of Engineers
231 S. LaSalle Street, Suite 1500
Chicago, IL 60604

Dear Ms. Chernich: January 19, 2016

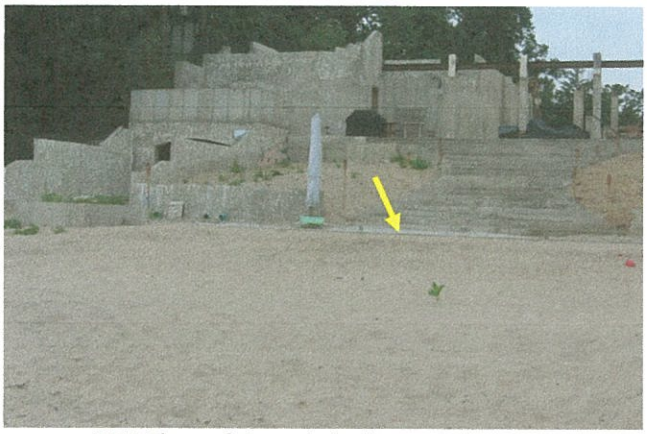
Please find enclosed a permit application for shore protection and sand nourishment for the properties located at 391 and 411 Sheridan Road, Winnetka, Illinois 60093, owned by Mr. Michael Hara. The shoreline stabilization will be comprised of two bay beach cells held by quarrystone breakwaters. The existing north groin (north of the north property line) is under permit review to be replaced by a quarrystone breakwater for the north neighbor. The proposed project for 391 and 411 Sheridan Road will have a quarrystone spur extending south from the proposed breakwater at 419 Sheridan Road. Then a quarrystone breakwater will be constructed extending north and south from the existing center steel groin and the existing south breakwater will be shortened and maintained. The new breakwaters will be installed extending less than 125' offshore from the existing bluff toe to help dissipate wave energy and to narrow the gap between the north groins. The existing shore protection structures in the south cell will be removed with the exception of the south breakwater and revetment. The proposed quarrystone breakwaters are designed to help reduce incident wave energy from eroding the sand and clay lakebed, to create a sustainable sand cover over the clay lakebed which reduces lakebed downcutting (deepening of the water) and helps to improve water quality caused by colloidal fines from the eroding clay being suspended in the water during storms.

Mr. Hara is also requesting a permit to allow placement of sand nourishment for 10 years after the project is complete. As the project consists of 2 beach cells, the request is for up to 1,000 tons of sand annually.

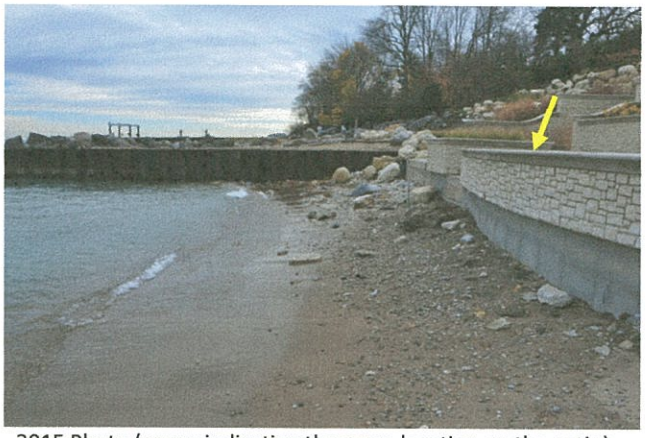
A *Design of Shoreline Erosion Protection* report has been attached to this cover letter as the coastal design specifications component of this permit. All references and figures referred to in the cover letter and the following report can be found in the Appendix.

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
From conversations with Mr. and Mrs. Hara it was never their intention to do any work along the lakefront. When they purchased the lots and started working on their home in 2008, a wide sandy beach provided shore protection and allowed for an open lakefront feeling which is what they desired. The new house was built behind the state and federal jurisdictions in accordance with permitting regulations and they enjoyed the lower Lake Michigan water levels and a wide sandy beach. Within the last year, the beach has deflated to a point where the existing patio foundation is exposed to stormwaves and access to the lake and across the property is difficult to non-existent.



2009 Photo of the patio (yellow arrow)



2015 Photo (arrow indicating the same location on the patio)

2015 photos of the lakefront looking south (left) and north (right)

In September of 2015, Mr. Hara retained Shabica & Associates (SA) to help stabilize the existing beach on the Lake Michigan coastline at 391 and 411 Sheridan Road, Winnetka. This project is designed to integrate two very different beach environments while creating proper shore protection. The 391 Sheridan site currently has an array of oddly situated shore protection structures holding a perched beach and the 411 Sheridan site has a narrow beach held by a steel groin that does not provide adequate protection for the existing deck and stair system built at the west edge of the beach. With the recent deflation of the north beach and the inability of the steel groins to dissipate wave energy, it is necessary to install a shore protection system that will help to prevent additional erosion to the lakebed and beach during all lake levels. Working with the homeowner, SA designed a cohesive system that utilizes the existing groins as a foundation for a quarrystone breakwater system in the north cell and cleans up the oddly designed south cell.

All beaches lose sand over time. Breakwater protected beaches typically loose sand at a slower rate than open beaches. The sand nourishment request for this project will allow the homeowner to place additional sand (up to 1,000 tons) annually or when necessary over a 10-year period. This sand nourishment then bleeds into the littoral system over time which is a benefit to downdrift properties.

PROJECT DESCRIPTION

The shoreline stabilization will be comprised of installing quarrystone breakwaters that are connected to existing structures (or proposed structures already under review at 419 Sheridan) to create a cohesive bay beach system with revetments prudently located. No new work will be done further than 125' east of the bluff toe per IDNR

guidelines. The project includes removal of several previously designed structures that are oddly located and in some cases impede access to Lake Michigan. Beginning at the north, a breakwater spur will be constructed extending southeast from the currently proposed breakwater at 419 Sheridan. This breakwater will have a crest of 583' and slopes of 1:1.5. Sections of quarrystone revetment will be constructed lakeward of the easternmost retaining walls as necessary for shore protection. Revetment crests will be up to the elevation of the retaining walls not to exceed 588' with a slope of 1:1. A quarrystone breakwater will be constructed extending north and south from the existing steel groin between the 391 and 411 lots. This breakwater will be 114' long (52' north and 62' south from the steel groin to the toe stone). The breakwater crest will be 584' with slopes of 1:1.5. Three structures on the 391 lot will be removed: the north breakwater, the concrete modular structures and the pile of armorstone in the middle of the beach that hold a perched beach. The south breakwater that extends north from the existing pier will be shortened and maintained. This structure does extend beyond 125' east from the shoreline, but its length will be reduced and the structure maintained to provide long-term stability. The crest will be reduced from a high of 588.5' to 586' tapering to 584' with slopes of 1:1.5. The revetment on the 391 lot will be maintained as necessary simply to fill void spaces and provide long-term stability. Approximately 2,962 cu. yds of clean sand will be placed as required by the IDNR.

The proposed system is designed to help retain the sandy beach, move the locus of wave energy further offshore, help reduce lakebed downcutting, and provide safe access for pedestrians to Lake Michigan.

The sand nourishment is for placement of up to 1,000 tons annually. Pending lake levels and beach conditions, sand placement will be completed as necessary to replenish sand lost to the system over time.

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 thick in some locations at this site (Figure 1, Appendix) and scientists estimate that the rate of lakebed erosion averages 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. While a beach has been present at this site during recent low lake levels, the current higher lake level has eroded the beach and the concrete deck and stairs are being impacted by stormwaves on a regular basis. If ignored, the beach will continue to deflate causing destabilization of the existing structures west of the beach.

One of the largest factors in determining the scope of a project is analyzing current lake levels and climactic conditions. Over the past few years, larger-than-normal stormwaves have impacted the shoreline of Lake Michigan, and with the higher lake level, many properties are in jeopardy of loss of structures and land. 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. If dryer conditions are

experienced, Lake Michigan will continue to reside at or around the current low lake level and the lakebed profile will steepen due to wave-induced erosion of the glacial clay till. This steeper, nearshore lakebed profile will allow larger waves to form (see attached USACE Shore Protection Manual diagram illustrating "Dimensionless design breaker height versus relative depth at structure"). The USACE chart shows that an increased slope of the lakebed will produce larger breaking waves. On the other hand, if wetter conditions are experienced, the impacts of increased lake levels will also be seen quickly, because deeper water allows larger waves to form.

In the past two years, Lake Michigan water levels have fluctuated over 4 feet in elevation taking water levels from the all-time recorded low in January, 2013, to today's water level around 579.0 (IGLD 1985). With that increase in water levels we are seeing the impacts of prolonged low lake levels evidenced with lakebed downcutting, deeper water nearshore, and more extreme sand fluctuation during average storm events.

Design Options

The site at 391 and 411 Sheridan Road, Winnetka has been inspected and options for shore protection were determined using desktop coastal engineering, bathymetric surveys from 2012, and more than 2 decades of observations of the shoreline conditions at this site. Given the beach erosion due to higher lake levels, as well as the uncertainty of future lake levels, it is prudent to engineer and design systems that will anticipate greater lakebed downcutting, higher amounts of beach erosion, more extreme storm events with larger waves, and potential land erosion. These four options were considered:

OPTION 1

Do Nothing –

The first option of "Do Nothing" results in leaving the currently eroding beach in its existing state. The structures at the west end of the beach are vulnerable wave action and undermining. Current lakebed clay elevations at the lakeward end of the south groin may lead to destabilization of the groin by ice. This option leaves the south beach cell cluttered with structures and unsafe access to Lake Michigan.

OPTION 2

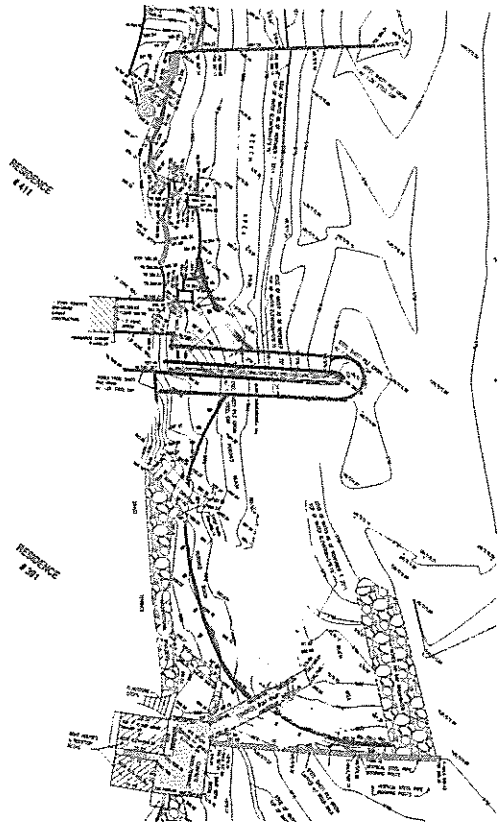
Encapsulate the Middle Groin and Remove Some Structures from South Beach –

This option shows removal of the north breakwater in the south beach cell as well as removal of the concrete modular structures and the piles of stones in the center of the south beach cell. The existing middle groin is encapsulated causing the structure to be more effective at dissipating wave energy and help to protect from toe scour at lakeward end. This option improves the ability of the groins to dissipate energy as well as help to hold sand within the system. However, as this option *does not* include breakwater spurs at the end the groins, the gap between the north and south groins remains too open to adequately protect the bluff and structures on the north beach from erosion. This option does not address lakebed erosion nor provide protection of the existing structures west of the beach.

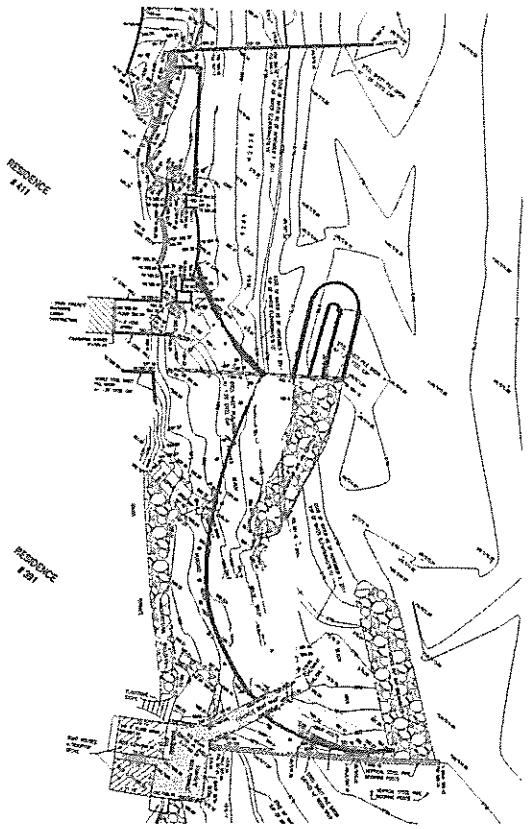
OPTION 3

Construct 1 Breakwater Spur and Remove Some Structures from South Beach –

In the north beach cell, this option shows a short breakwater spur extending north from the existing steel groin. Additionally, there is removal of the concrete modular structures in the south cell as well as removal of the pile of stone in the middle of the south beach. This option does not adequately address lakebed erosion nor protection the structures west of the beach.



Option 2 shows groin encapsulation with stone, as well as removal of one breakwater, concrete modular structures and stone pile in middle of south beach cell



Option 3 shows stone spur breakwater extending north from middle steel groin, as well as removal of concrete modular structures and pile of stone in middle of south beach cell

OPTION 4

Proposed Option: Construct/Maintain Three Quarrystone Breakwaters to Create a Breakwater Protected Bay Beach System

The proposed system is designed to fall within the IDNR guidelines with no new structures extending further lakeward than 125' of the bluff toe or seawall. This system will utilize the existing steel groin by connecting a quarrystone breakwater to the lakeward end of the groin, connecting a quarrystone breakwater to the proposed quarrystone breakwater currently under review for the north neighbor and shortening and maintaining the existing southernmost breakwater. This design also provides a quarrystone revetment immediately east of the existing concrete structures on the north beach and toe protection for the existing boat ramp on the south beach. This system will be filled with pre-mitigational sand, and will help protect the cohesive clay lakebed and property in a sustainable manner.

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 reduce lakebed downcutting, a source of fine clay pollutants.
3) Beaches support endangered species such as sea rocket, marram grass, and seaside spurge.
4) Beaches make better wildlife habitat than actively eroding bluffs or seawalls.
5) Stone headlands make better fish habitat than eroding lakebed clay.
6) Beaches protect the lakebed from erosion that causes larger stormwaves to impact the shore.
7) 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 35 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 is 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 regioally. 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 adjacent lakeshore. Periodic sand re-nourishment has proven to be a sucessful management tool and provides additional sand for the entire Illinois coastal ecosystem.

Impact to Littoral Drift System

The proposed plan for this site includes construction of 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. The existing section of Lake Michigan shoreline at 391 and 411 Sheridan Road, Winnetka is completely engineered. This section of the coastline consists of breakwater-held beaches, groins and revetments. Sand mitigation (as required by the IDNR) will be placed within the system with a 20% overfill as required.

The proposed quarrystone breakwaters will extend less than 125' offshore, the southernmost breakwater will be shortened and maintained within its current footprint (extending to approximately 140' offshore). The proposed structures have been designed to fit in with the adjacent structures. The littoral drift system should remain at an equilibrium once the mitigational sand is placed (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

Public access will not be impacted implemented as the proposed work is all offshore with the exception of the revetment in the north cell. The beach will provide 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 structure immediately to the north.

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
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 crane or backhoe 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. Work will not begin until all necessary permits have been received. This work will require approximately 14 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 1,160 cubic yards of clean quarried stone will be placed to construct the breakwater. Approximately 2,962 cu. yds of clean sand will be placed as sandfill in and around the system. All clay removed from the lakebed for proper placement of the toe stone will be placed on a barge and disposed of properly.

The amount of fill to be placed below the Ordinary High Water Mark (581.5 feet, IGLD 1985) is +/- 0.13 acres.

Summary
All of the above described activities and plans will follow IPP 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 and the Illinois Historic Preservation Association 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

cc: IDNR, Water Resources (Casey)
IEPA (Heacock)

U.S. Fish & Wildlife Service
Illinois Historic Preservation Agency (Haaker)
Michael Hara

DESIGN OF SHORELINE EROSION PROTECTION

Introduction

The following report summarizes assumptions and design criteria for a quarrystone breakwater system and sandfill to help retain a beach, provide lake access, and better protect the property located at 391 and 411 Sheridan Road, Winnetka. The design is based on the drawings included in the permit application to the U.S. Army Corps of Engineers dated October 30, 2015.

The site lies within a fully-engineered section of urban lakeshore that is typically protected with steel sheetpile groins, revetments and breakwater-protected beaches. This section of coast is sand-starved due to municipal structures (littoral barriers) constructed over the past 100 years that extend east past the littoral zone and reduce sand bypass, as well as armoring of the shoreline reducing erosion of the glacial clay bluffs. According to the Illinois State Geological Survey, there is almost no sand moving along this section of coast. All structures in the area have been steadily losing their effectiveness at holding beach sand. This problem is exacerbated by lakebed erosion. In many cases where all the sand has been lost, the adjacent bluffs have begun to erode. To provide adequate protection for the upland property, solutions have typically been of two types: breakwater- or groin-anchored beaches to protect the bluffs, or a lower-cost system with a lower level of protection in the form of quarrystone revetments placed against the toe of the bluff that prevents stormwave erosion but at the expense of the beach and pedestrian access.

Project Description

The proposed design includes designing a headland bay beach system with three shore-connected breakwaters (one of which is existing), the north breakwater extend southeast from the north neighbor's proposed breakwater, the central breakwater will form a "T" on the end of the existing steel sheetpile groin and the existing south breakwater will remain in place extending north from the south pier being shortened and maintained. This system will reduce the gap between the existing steel groins on the north section of the property, while the south beach area will be cleaned up removing extraneous rocks and concrete structures on the beach to leave a bay beach cell. The project will include sandfill mitigation that fulfills the design requirements of 20-year stormwave erosion protection. With the current elevated lake, stormwaves are causing severe erosion problems and impacts to the property, as well as may cause deeper water in the nearshore. The breakwater-protected beach system is designed to help retain and enhance the beach that occurs on this property.

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:	584 ft
Toe of Breakwater:	575 ft
Crest Width:	7 ft
Average Armor Size:	3.5 tons
"B" Stone	400 - 1200 lbs
Slope:	1:1.5
Tons/linear ft:	13.6 tons

Assumptions

• Design High Water (DHW):	582.0 ft *
• Design Water Level:	580.0 ft
• Design Low Water (DLW):	577.5 ft *
• Existing clay till elevation at groin toe:	574.0 ft
• 20-yr lakebed erosion at toe of groin:	3 ft**
• Design wave height:	Hs = 10.8 ft
• Nearshore Slope:	1:20
• Design Wave Period (T):	9.9 s **
• Depth at Structure Toe DHW (Ds):	9.0'
• 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

Bathymetry
Bathymetric surveying was performed in November 7, 2011. Six transects were completed in the project area and on adjacent properties. The survey data points were taken to approximately 300 feet east from the seawall. The survey was performed using an electronic total station with a diver in the water and a licensed survey crew on land. Reference benchmark: Per Monument Records for the Center of Section 21-42-13 on file with the Village of Winnetka, benchmark is the top of brass plug in concrete witness monument in the north parkway of Willow Road near the east line of Residence #467. Elevation = 613.21' NAVD 1988 Datum.

Topographic surveys of the lakefront and beach area were updated on August 4, 2014 and again on May 28, 2015 which show a severe deflation of the beach and erosion to the lakefront.

Water Levels
The following table summarizes water level data representing daily highest extremes measured at Calumet Harbor, Illinois, approximately 24 miles to the south of Winnetka. 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. Rod and transit survey monitoring will be conducted, as required by the IDNR, to 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) has been overlain on the proposed shore protection system. 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 Winnetka lakeshore is considered sediment-starved. Sand deposits were measured near this site (Elder Lane in Winnetka). Sand deposits were thin to a distance of 160 ft from shore (Shabica, 2010) and sand was non-existent in areas to a distance of over 1000 ft from shore(Shabica & Pranschke, 1994). Also, the site is underlain by highly-erodable, cohesive glacial clay-till. This condition increases the rate of irreversible lakebed erosion that causes deepening of the water and larger waves to impact the shoreline. 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, 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 breakwater and sandfill installed, the lakebed erosion will be reduced.

Stone Stability, Armorstone
The proposed shore parallel section of the quarrystone breakwater will have two layers of 2 to 5-ton armorstone placed on a 1:1.5 slope. Overtopping of the breakwater is expected during high water levels. Design conditions include:

- Lakeward breakwater crest elevation at 2.0 ft above DHW, 6.5 ft above DLW
- Depth-limited breaking waves will break on the stone groin and sand beach

- Depth at the toe of the structure is 8 ft (574.0) at DHW
- 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 was used to estimate armorstone size. Using the design conditions, an armorstone of 3.8 tons is predicted for single layer special placement.

Project Monitoring

As the performance of shore protection structures cannot be predicted with absolute certainty, the shore protection system for 391 and 411 Sheridan Road, Winnetka, 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.

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.

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.

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

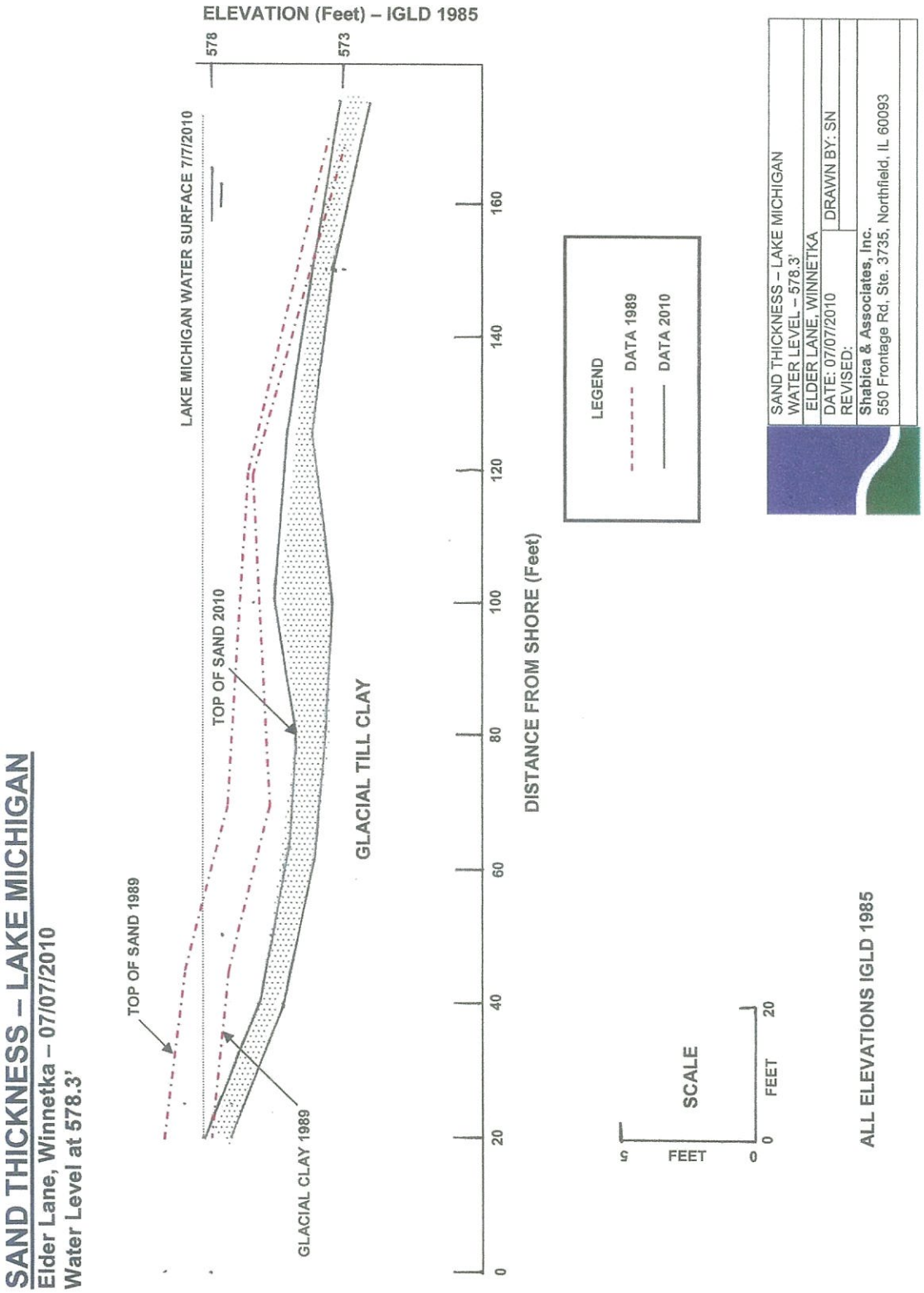
Shabica, C.W., F. Pranschke and M. Chrzastowski. 1991, *Survey of Littoral Drift Sand deposits Along the Illinois Shore of Michigan from Fort Sheridan to Evanston*, Illinois/Indiana Sea Grant Program, IL-IN-SG-R-91-3.

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.

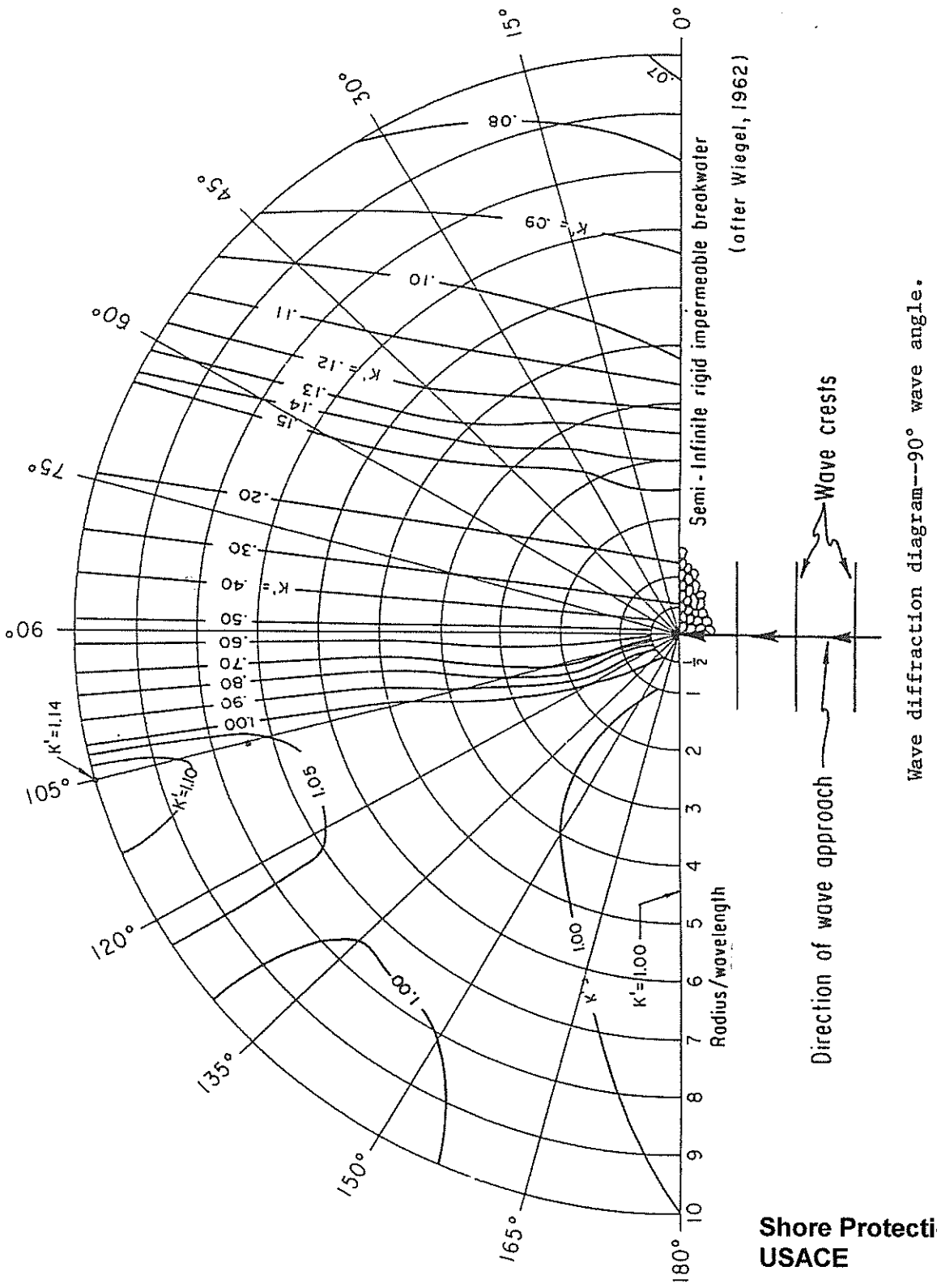
US Army Corps of Engineers, 1984, *Shore Protection Manual*, Coastal Engineering Research Center, Vicksburg, Mississippi.

FIGURE 1



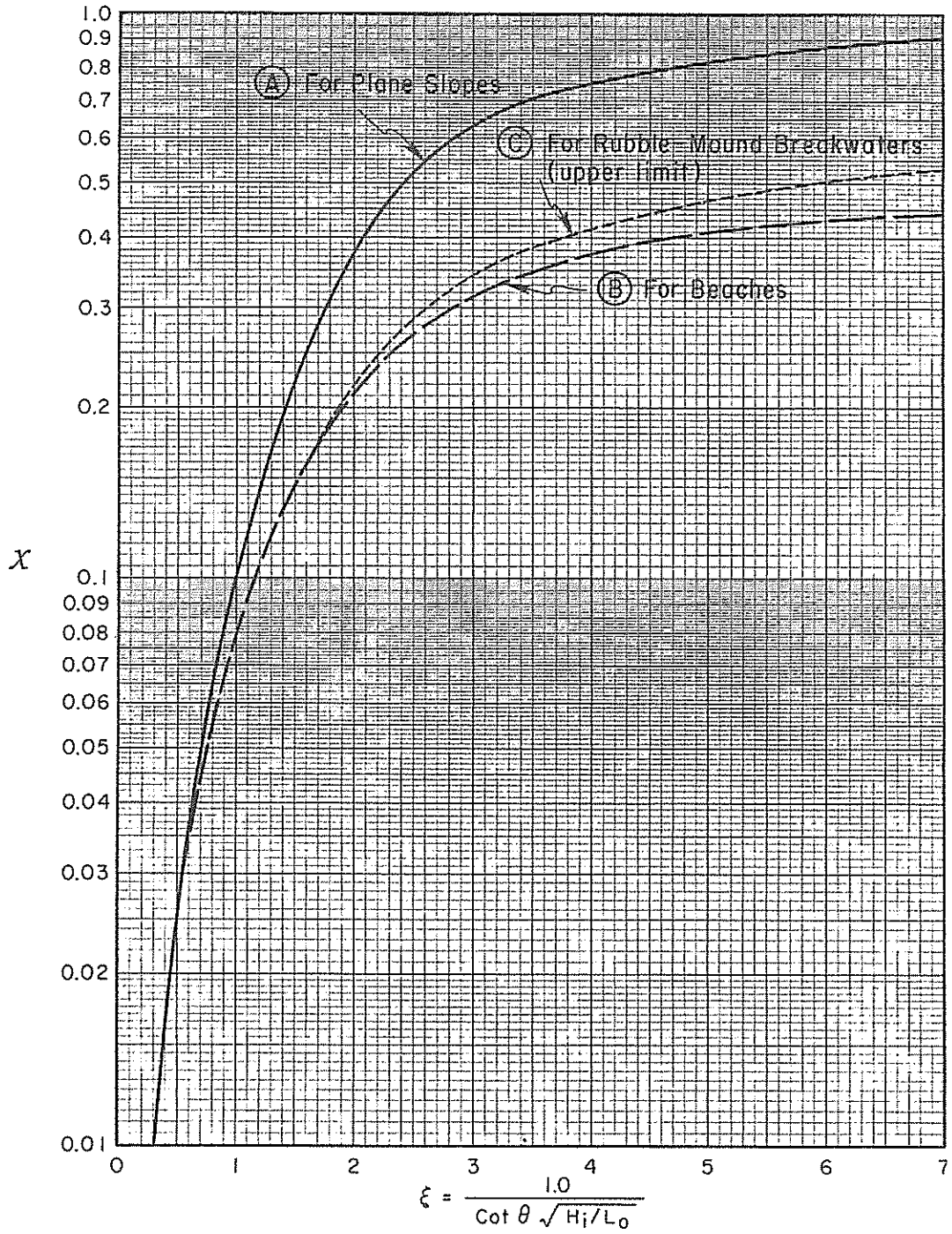
Typical cross-section of Winnetka lakebed and sand cover
(From Shabica et al., 1991)

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

2015 Google Earth Photo; see approximate property lines

2015 North beach cell with narrow beach during lake levels 1 ft over LWD. During even small lake storms, the concrete structures are vulnerable to wave attack and undermining.

2015 South beach cell with cobble beach. Concrete modular structures inhibit pedestrian access to the lake. Stone pile in the center of the beach (right side of photograph) hold a perched beach landward.

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):
Michael Hara		Shabica & Associates, Inc.
Company Name (if any) :	Company Name (if any):	Company Name (if any): Shabica & Associates, Inc.
Address: 285 N Deere Park Drive E Highland Park, IL 60035	Address:	Address: 550 Frontage Road Suite 3735 Northfield, IL 60093
Email Address:	Email Address:	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, Inc. 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 permit application.

Applicant's Signature — Date: 9/23/15

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 System

7. PROJECT LOCATION:
411 & 391 Sheridan Road, Winnetka, IL 60093

LATITUDE: 42.10294 °N
LONGITUDE: 87.71942 °W

UTMs
Northing: 4661446.87
Easting: 16T440518.72

STREET, ROAD, OR OTHER DESCRIPTIVE LOCATION	LEGAL DESCRIPT	QUARTER	SECTION	TOWNSHIP NO.	RANGE
Sheridan Road		NW	21	42N	13E

☒ IN OR ☐ NEAR CITY OF TOWN (check appropriate box)
Municipality Name: Winnetka

WATERWAY: Lake Michigan

RIVER MILE (if applicable):

COUNTY	STATE	ZIP CODE
Cook	IL	60093

Revised 2010

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

8. PROJECT DESCRIPTION (Include all features):

The shoreline stabilization will be comprised of installing quarrystone breakwaters that are connected to existing structures (or proposed structures already under review) to create a cohesive bay beach system with revetments prudently located. No new work will be done further than 125' east of the bluff toe. The project includes removal of several previously designed structures that are oddly located and in some cases impede access to Lake Michigan. Beginning at the north, a breakwater spur will be constructed extending southeast from the currently proposed breakwater on the north property (419 Sheridan). This breakwater will have a crest of 583' and slopes of 1:1.5. Sections of quarrystone revetment will be constructed lakeward of the easternmost retaining walls as necessary for shore protection. Revetment crests will be up to the elevation of the retaining walls not to exceed 588' with a slope of 1:1. A quarrystone breakwater will be constructed extending north and south from the existing steel groin between the 391 and 411 lots. This breakwater will be 114' long (52' north and 62' south from the steel groin to the toe stone). The breakwater crest will be 584' with slopes of 1:1.5. Three structures on the 391 lot will be removed: the north breakwater, the concrete modular structures and the piles of armorstone in the middle of the beach that hold a perched beach. The south breakwater that extends north from the existing pier will be shortened and maintained. This structure does extend beyond 125' east from the shoreline, but its length will be reduced and the structure maintained to provide long-term stability. The crest will be reduced from a high of 588.5' to 586' tapering to 584' with slopes of 1:1.5. The revetment on the 391 lot will be maintained as necessary simply to fill void spaces and provide long-term stability. Approximately 2962 cu. yds of clean sand will be placed as required by the IDNR. Additionally, the applicant is requesting approval for a 10-year sand nourishment permit to bring in up to 1000 tons of sand annually, as needed.

9. PURPOSE AND NEED OF PROJECT:

To maintain a stable beach and lakebed as well as protect the existing structures built into the bluff.

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

10. REASON(S) FOR DISCHARGE:

To provide adequate shore protection within an engineered section of coastline.

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

TYPE: Stone and sand

AMOUNT IN CUBIC YARDS:

Stone: 1160 cu. yds; Sand: 2962 cu. yds.

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

New stone will cover +/- 0.13 acres

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

Existing infrastructure will be utilized in the proposed plan. Extraneous structures on the 391 lot will be removed. Wetland Mitigation Banking Credits will be purchased according to regulatory requirement.

14. Date activity is proposed to commence: August 1, 2016

Date activity is expected to be completed: 14 weeks

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 [X] 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.

Signature of Applicant or Authorized Agent _____ Date _____

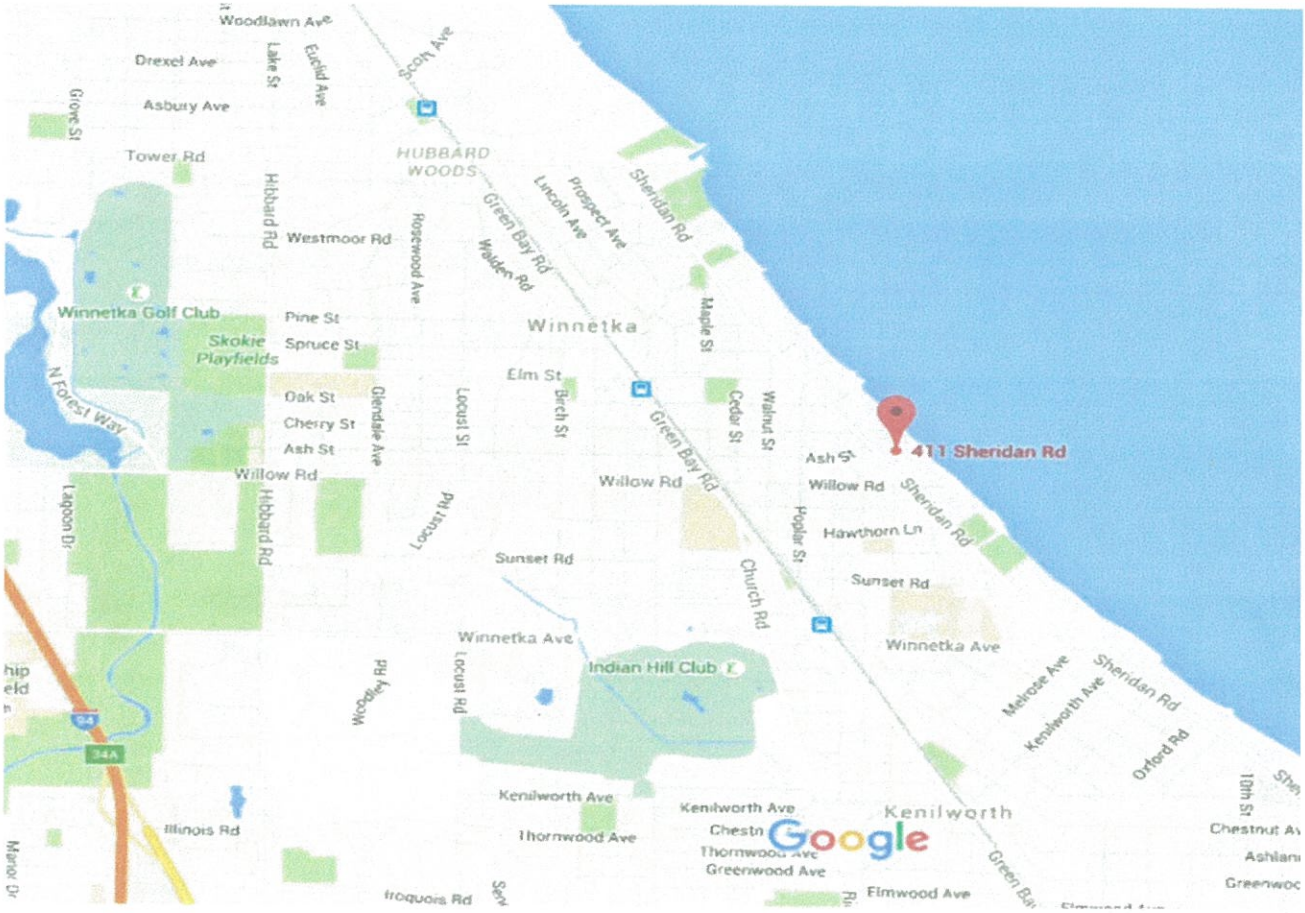
Signature of Applicant or Authorized Agent _____ Date _____

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

391 and 411 Sheridan Road
Winnetka, IL 60093

Shabica & Associates, Inc.
WE BUILD BEACHES

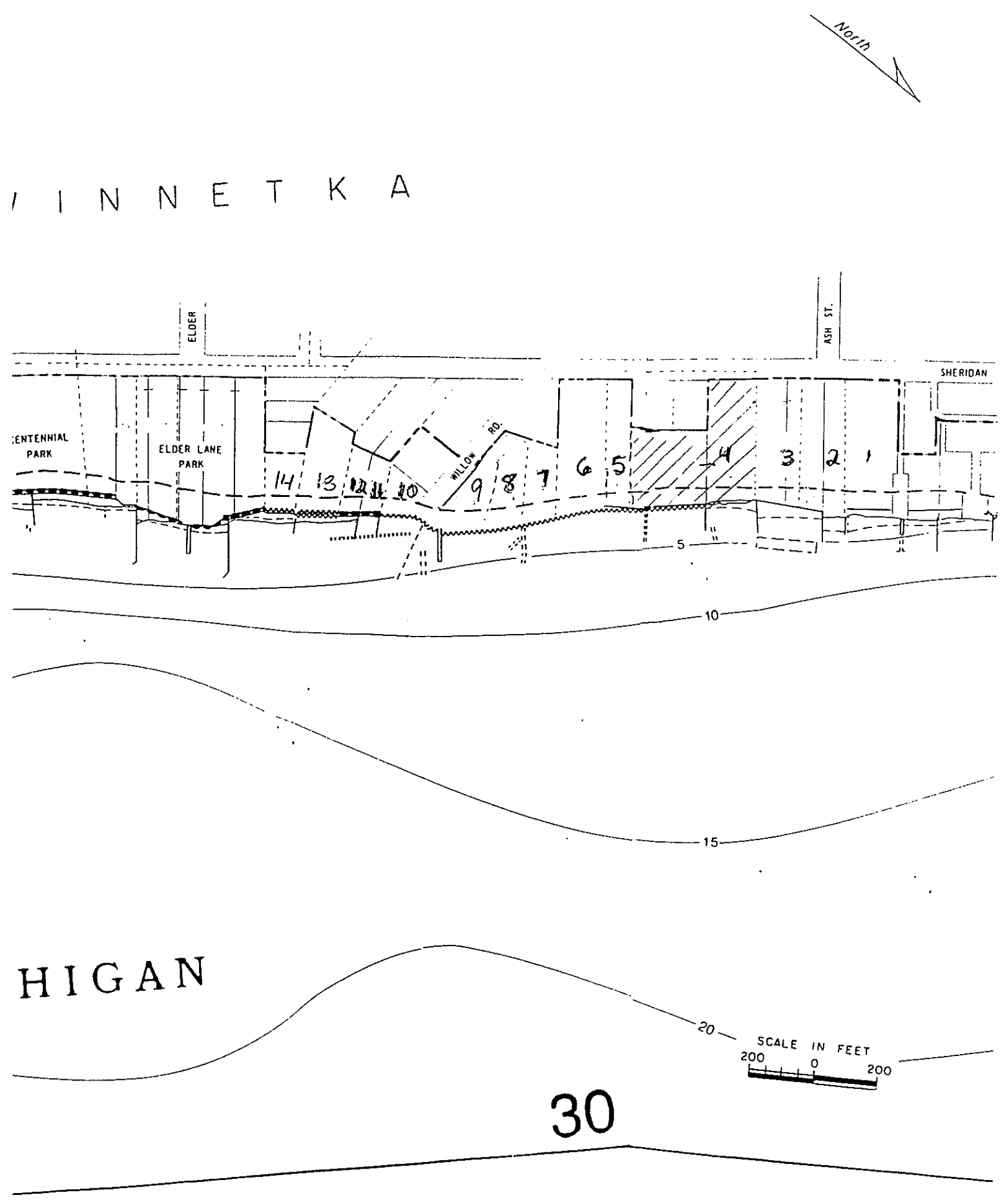
Title:	Construction of a quarrystone breakwater along Lake Michigan Michael Hara 391 and 411 Sheridan Road Winnetka, Illinois 60093
Submittal Date:	January 19, 2016
Plan Sheets:	2015.10.22 Hara Existing Bathymetry – Sheet 1 of 6 2015.10.22 Hara Plan View – Existing Structures – Sheet 2 of 6 2015.10.19 Hara Plan View – Proposed Work – Sheet 3 of 6 2015.10.22 Hara Cross Sections: Breakwater and Revetment – Sheet 4 of 6 2015.10.19 Hara Plan View – Sand – Sheet 5 of 6 2015.10.28 Hara Sand Calculations – Sheet 6 of 6

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

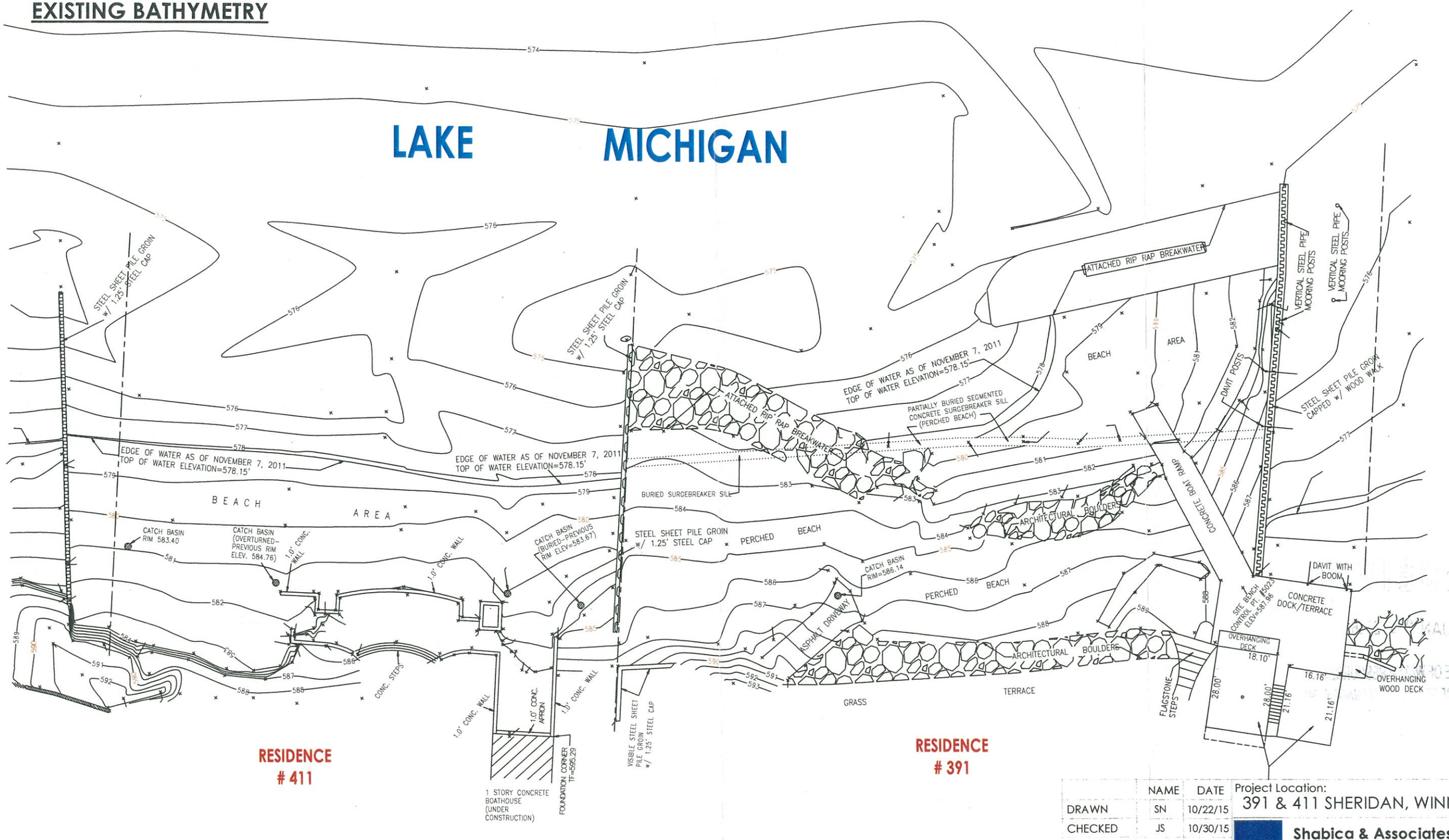
Shabica & Associates, Inc.
WE BUILD BEACHES

Title:	Construction of a quarrystone breakwater along Lake Michigan Michael Hara 391 and 411 Sheridan Road Winnetka, Illinois 60093
Submittal Date:	January 19, 2016
Plan Sheets:	2015.10.22 Hara Existing Bathymetry – Sheet 1 of 6 2015.10.22 Hara Plan View – Existing Structures – Sheet 2 of 6 2015.10.19 Hara Plan View – Proposed Work – Sheet 3 of 6 2015.10.22 Hara Cross Sections: Breakwater and Revetment – Sheet 4 of 6 2015.10.19 Hara Plan View – Sand – Sheet 5 of 6 2015.10.28 Hara Sand Calculations – Sheet 6 of 6

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


North
INNETKA
ELDER
ASH ST.
SHERIDAN
ENTENNIAL PARK
ELDER LANE PARK
WILLOW RD.
14 13 12 11 10 9 8 7 6 5 4 3 2 1
5
10
15
20
HIGAN
SCALE IN FEET
200 0 200
30

EXISTING BATHYMETRY



	NAME	DATE
DRAWN	SN	10/22/15
CHECKED	JS	10/30/15

Project Location:
391 & 411 SHERIDAN, WINNETKA

COMMENTS:

DIMENSIONS ARE IN FEET
TOLERANCES: +.5', -1'
ALL ELEVATIONS IN IGLD 1985

Shabica & Associates, Inc.
550 Frontage Rd., Suite 3735
Northfield, Illinois 60093
847-446-1436
www.shabica.com

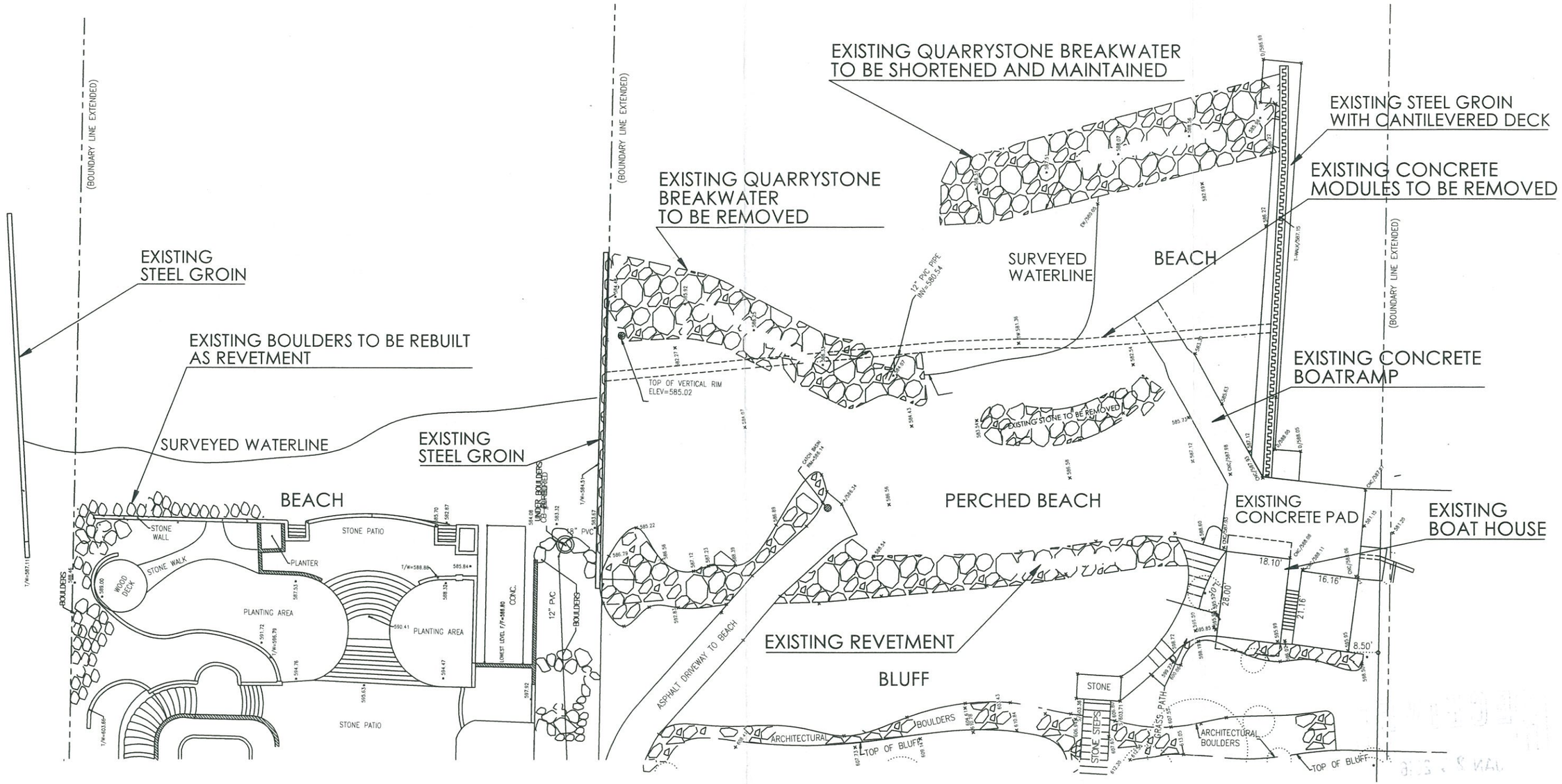
SIZE B

REV

EXISTING BATHYMETRY

SHEET 1 OF 6

PLAN VIEW - EXISTING STRUCTURES



.0833
SCALE

	NAME	DATE
DRAWN	SN	10/22/15
CHECKED	JS	10/30/15

Project Location:
391 & 411 SHERIDAN, WINNETKA

COMMENTS:

DIMENSIONS ARE IN FEET
TOLERANCES: +.5', -1'
ALL ELEVATIONS IN IGLD 1985

Shabica & Associates, Inc.
550 Frontage Rd., Suite 3735
Northfield, Illinois 60093
847-446-1436
www.shabica.com

SIZE B | REV

PLAN VIEW
EXISTING STRUCTURES

PLAN VIEW

COVERAGE OF NEW FILL ON THE LAKEBED BELOW THE OHWM IS 0.13 ACRES

LAKE MICHIGAN

PROPOSED BREAKWATERS APPROXIMATELY 120' EAST OF ORIGINAL BLUFF TOE

MODIFY & MAINTAIN EXISTING BREAKWATER OVER EXISTING FOOTPRINT

584' TAPERS 586'

CREST 584'

583'

580'

STEEL SHEET PILE GROIN w/ 1.25' STEEL CAP

VERTICAL STEEL PIPE MOORING POSTS

DAVIT POSTS

EXISTING STEEL SHEET PILE GROIN CAPPED w/ WOOD WALK

TOESTONE TO BE PLACED ABUTTING EXISTING RAMP

SANDFILL

OHWM

WATERLINE @ DWL 580'

BEACH

BEACH SYSTEM FOR 419 SHERIDAN UNDER SEPARATE PERMIT REVIEW

EX. CONCRETE BOAT RAMP

DAVIT WITH BOOM

EX STONE WALL

EX STONE PATIO

STONE WALK

PLANTER

WOOD DECK

PROPOSED REVETMENT

PLANTING AREA

CATCH BASIN RIM=583.51 (BURIED-PREVIOUS RIM ELEV=583.67)

CATCH BASIN RIM=586.14

EX. ASPHALT DRIVEWAY

ARCHITECTURAL BOULDERS

GRASS TERRACE

MAINTAIN REVETMENT AS NECESSARY

SITE BENCH MARK CONTROL PT. #5023 ELEV=587.86

CONCRETE DOCK/TERRACE

OVERHANGING DECK 18.10'

OVERHANGING WOOD DECK

16.16'

21.16'

28.00'

FLAGSTONE STEPS

419 SHERIDAN

RESIDENCE # 411

RESIDENCE # 391

1 STORY CONCRETE BOATHOUSE (UNDER CONSTRUCTION)

VISIBLE STEEL SHEET PILE GROIN w/ 1.25' STEEL CAP

30'

	NAME	DATE
DRAWN	SN	10/19/15
CHECKED	JS	10/20/15

Project Location:
391 & 411 SHERIDAN, WINNETKA

COMMENTS:

DIMENSIONS ARE IN FEET
TOLERANCES: +.5', -1'
ALL ELEVATIONS IN IGLD 1985

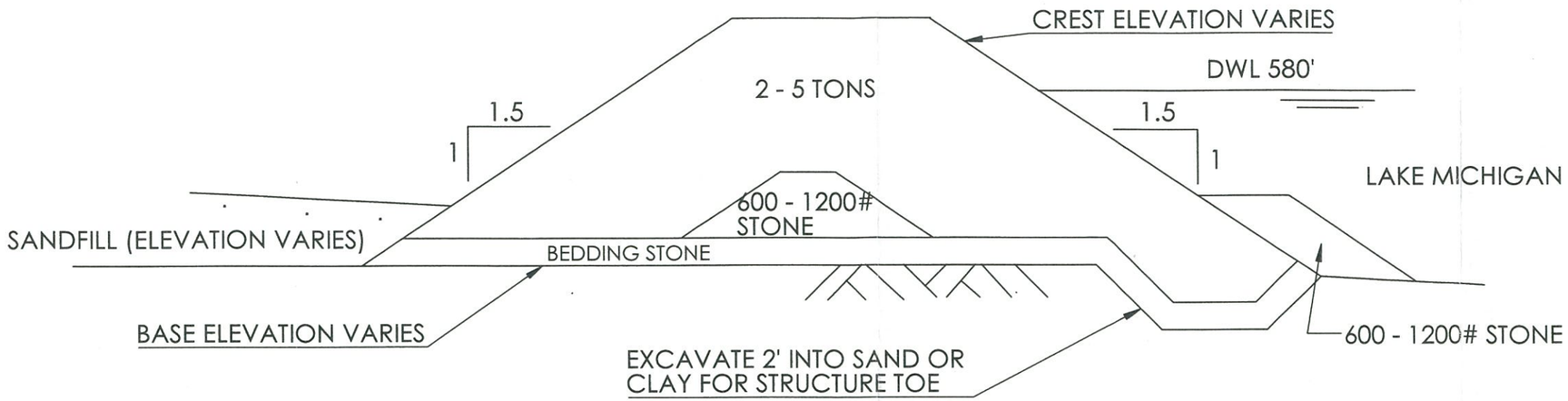
Shabica & Associates, Inc.
550 Frontage Rd., Suite 3735
Northfield, Illinois 60093
847-446-1436
www.shabica.com

SIZE B

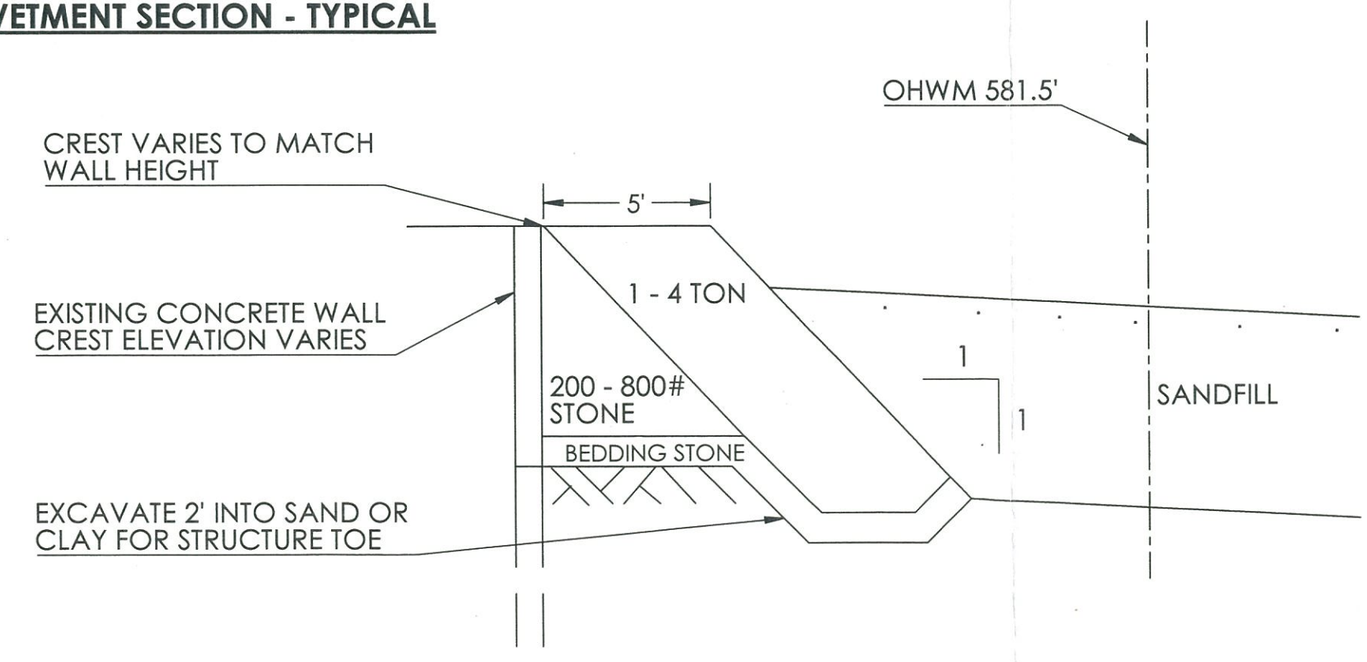
PLAN VIEW
PROPOSED WORK

REV

BREAKWATER SECTION - TYPICAL



REVETMENT SECTION - TYPICAL



	NAME	DATE
DRAWN	SN	10/22/15
CHECKED	JS	10/30/15

Project Location:
391 & 411 SHERIDAN, WINNETKA

COMMENTS:

DIMENSIONS ARE IN FEET
TOLERANCES: +.5', -1'
ALL ELEVATIONS IN IGLD 1985

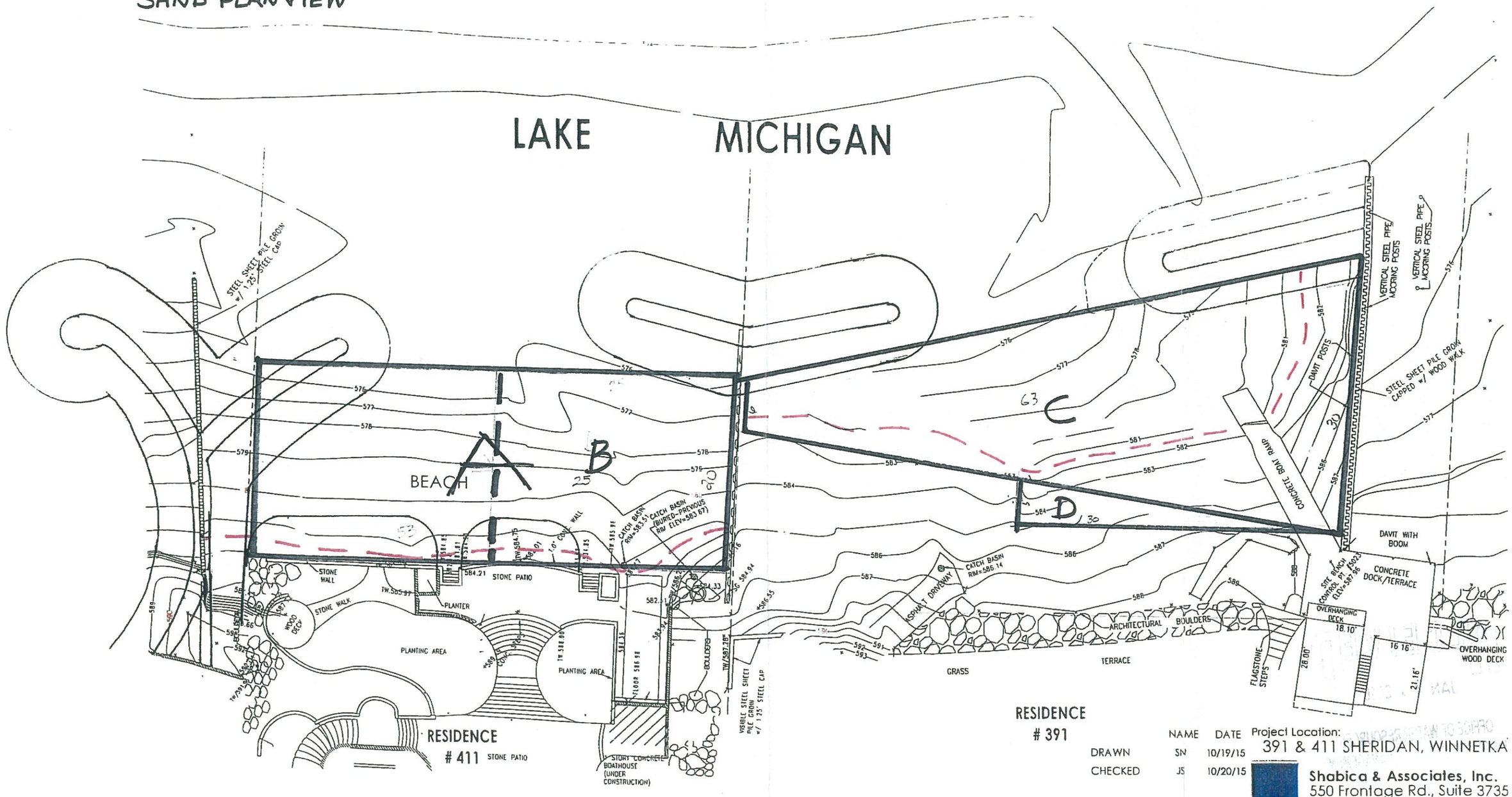
Shabica & Associates, Inc.
550 Frontage Rd., Suite 3735
Northfield, Illinois 60093
847-446-1436
www.shabica.com

SIZE B

CROSS SECTIONS: BREAKWATER AND REVETMENT

REV

SAND PLANVIEW



	NAME	DATE
DRAWN	SN	10/19/15
CHECKED	JS	10/20/15

Project Location:
391 & 411 SHERIDAN, WINNETKA

COMMENTS

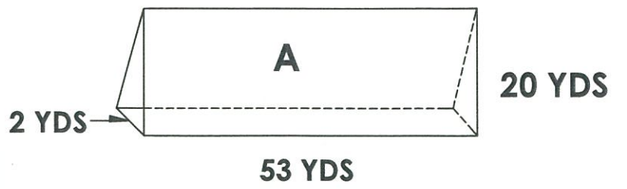
DIMENSIONS ARE IN FEET
TOLERANCES: +.5', -1'
ALL ELEVATIONS IN IGLD 1985

Shabica & Associates, Inc.
550 Frontage Rd., Suite 3735
Northfield, Illinois 60093
847-446-1436
www.shabica.com

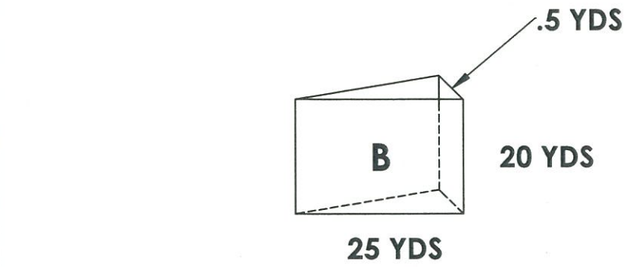
SIZE B

PLAN VIEW - SAND

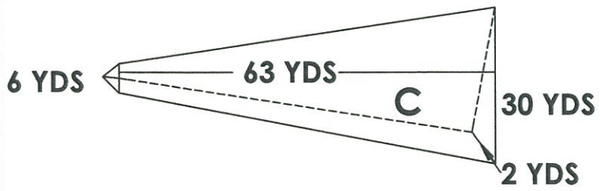
REV



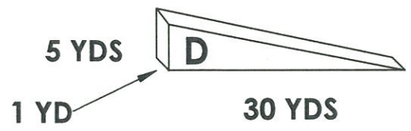
$$\frac{20\ \text{YDS} \times 53\ \text{YDS} \times 2\ \text{YDS}}{2} = 1060\ \text{YDS}$$



$$\frac{20\ \text{YDS} \times 25\ \text{YDS} \times 0.5\ \text{YDS}}{2} = 125\ \text{YDS}$$



$$\frac{18\ \text{YDS}^* \times 63\ \text{YDS} \times 2\ \text{YDS}}{2} = 1134\ \text{YDS}$$



$$5\ \text{YDS} \times 30\ \text{YDS} \times 1\ \text{YD} = 150\ \text{YDS}$$

1060 + 125 + 1134 + 150 = 2469 CU YDS

2469 CU YDS X 1.25 CU YDS/TON = 3,086 TONS

3,086 TONS X 20% OVERFILL = 617 TONS

3,086 TONS + 617 TONS = 3703 TONS

PLACE 3,720 TONS OF CLEAN SANDFILL

* AVERAGE 6 AND 30 TO COME UP WITH 18 YDS

	NAME	DATE
DRAWN	SN	10/28/15
CHECKED	JS	11/2/15

COMMENTS:

DIMENSIONS ARE IN FEET
TOLERANCES: +.5', -1'
ALL ELEVATIONS IN
IGLD 1985

Project Location:
391 & 411 SHERIDAN, WINNETKA

Shabica & Associates, Inc.
550 Frontage Rd., Suite 3735
Northfield, Illinois 60093
847-446-1436
www.shabica.com

SIZE B

REV

SAND CALCULATIONS

SHEET 6 OF 6