CITY OF EVANSTON

SHORELINE IMPLEMENTATION ROADMAP

SMITHGROUP

10/16/2020

TABLE OF CONTENTS

South Boulevard Beach

1. EXECUTIVE SUMMARY

During the winter of 2019/20, the City of Evanston, along with many other communities around the Lake Michigan coastline, was subjected to a series of damaging storm events with high winds and large waves resulting in flooding, erosion and lakefront property damage. The recent storms were exacerbated by historic high water levels, which have continued throughout 2020, and are expected to persist at above average levels through the winter of 2020/21. Anticipating further damaging storms, the City has conducted a condition assessment and prioritization of the publicly-owned lakefront shore protection features and developed this guidance document, which contains recommendations for short and mid-term resilience measures.

Observations from the condition assessment identified several areas of concern along Evanston's lakefront. The primary method of protection is a series of rubblemound revetments which were installed during the 1980s in response to a previous episode of record-high water levels. Issues requiring either short- or mid-term interventions include loss of revetment section, insufficient freeboard, armor stone displacement and/or disintegration, and exposure of more easily erodible foundation materials.

The most urgent needs that were identified during the assessment and prioritization process have begun to be addressed through procurement of shoreline improvements and temporary flood protection (Public Bid 20-36). This document describes a series of potential interventions to be considered in the medium-term (approximately 2021-2025), which build from Goal 1 of the City's Lakefront Master Plan: "Establish practices and policies to preserve and enhance the lakefront's natural environment". These interventions are categorized as:

- Temporary and/or Non-Capital Intensive;
- Capital: Rehabilitation of Existing Structures; and
- Capital: New Structures and Features.

The overarching philosophy of the potential future improvements is to protect the shoreline and keep the lakefront as a community asset that is usable and accessible to residents. A component of this is to provide adequate protection that allows for the maintenance and improvement of multi-use trails, and supports the City's preferred recreational, cultural, and educational programming, including enhancement of natural habitat areas.


LEGEND
Property line between private and COE owned lakefront property
COE
City of Evanston owned lakefront property
CITY LIMITS
NORTH
COE
LIGHTHOUSE BEACH
COE
WATER TREATMENT PLANT
CLARK STREET BEACH
DOG BEACH
CHURCH STREET LAUNCH RAMP
DAWES PARK
COE
GREENWOOD STREET BEACH NORTH
DEMPSTER BEACH
DEMPSTER LAUNCH FACILITY
ELLIOT PARK NORTH
ELLIOT PARK SOUTH
LEE STREET BEACH NORTH
LEE STREET BEACH SOUTH
COE
CLARK SQUARE
GARDEN PARK NORTH
GARDEN PARK SOUTH
SOUTH BOULEVARD BEACH NORTH
COE
SOUTH BOULEVARD BEACH SOUTH
SHERIDAN ROAD REVETMENT
CITY LIMITS

2. CONDITION ASSESSMENT

On March 11, 2020, SmithGroup conducted a shoreline condition assessment with staff from the City of Evanston. Field observations focused primarily on the physical condition of the shoreline protection features at each site. Surrounding site conditions were observed, and City staff shared anecdotal information about the history and performance of the protection structures. The information collected was used to qualitatively classify each shoreline into one of five categories with a respective numeric value.

The numeric values and description of each category are as follows:

1 **NEW OR EXCELLENT CONDITION** | Structure appears new and/or has consistently uniform slopes and grades, with very few obvious signs of degradation.

2 **MINOR DEFECTS ONLY** | Approximately 90% of the structure has uniform slopes and grades, with occasional and sporadic cases of degradation.

3 **MODERATE DETERIORATION** | Approximately 75% of the structure has uniform slopes and grades. Deterioration observed impacts the section integrity at multiple locations.

4 **SIGNIFICANT DETERIORATION** | Approximately 50% of the structure has uniform grades and slopes. Deterioration is impacting section integrity at multiple locations, and underlying materials or foundations are exposed.

5 **VIRTUALLY UNSERVICEABLE** | Less than 25% of structure has uniform grades and slopes. Deterioration is impacting section integrity at most locations, such that structure has essentially failed.

Table 1a presents a summary of the physical condition rating for each location, and indicates the observed issues with respect to the shore protection features. Table 1b presents similar information with respect to the adjacent parklands and beaches.

Table 1a: Condition Assessment Summary (Shoreline Protection Features)

PARK NAME	CONDITION RATING	SECTION LOSS	NARROW / NO CREST PROTECTION	EXPOSED UNDERLAYER	STEEP REVETMENT SLOPE	EXPOSED SHEET PILE WALL	OVERTOPPING
Sheridan Road Revetment	3	X	X	X	X		X
South Boulevard Beach - South	2	X	X				
South Boulevard Beach - North	2	X	X				
Garden Park - South	2	X	X	X			
Garden Park - North	4	X	X	X	X	X	X
Clark Square	3				X	X	
Lee Street Beach - South	2						
Lee Street Beach - North	2		X				X
Elliot Park - South	3	X		X	X		X
Elliot Park - North	2	X			X		X
Dempster Launch Facility	4	X	X		X		X
Dempster Beach	2						
Greenwood Beach - North	4	X	X	X	X		
Dawes Park	2	X	X	X			
Church Street Launch Ramp	1						
Dog Beach	2	X	X				
Clark Street Beach	2						
Lighthouse Beach	2						
Water Treatment Plant	2						

Table Definitions:

Section Loss: Obvious loss of material resulting in deviation from general slopes and grades.

Narrow Crest: Appears to have less than 2 x average stone diameter width at crest.

Exposed Underlayer: Smaller sized bedding or underlayer stone is clearly visible without armor stone protection.

Steep Revetment: Lakeward slope of revetment appears to be at approx. 1:1 or steeper.

Overtopping: Visual evidence of recent wave overtopping (debris, small rocks, flattened vegetation on land side).

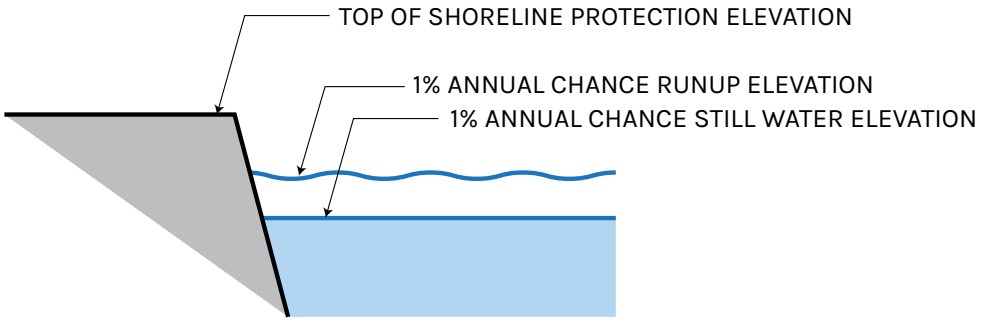
Table 1b: Condition Assessment Summary (Parkland & Beaches)

PARK NAME	CONDITION RATING	EROSION	FLOODING / PONDING	DAMAGED GABIONS	MARGINAL DRY BEACH WIDTH	EXPOSED H-PILE WALL	GRAVEL/ STONE BUILD-UP	SAND TRANSPORT
Sheridan Road Revetment	3							
South Boulevard Beach - South	2	X					X	
South Boulevard Beach - North	2	X			X			
Garden Park - South	2	X						
Garden Park - North	4	X						
Clark Square	3	X		X				
Lee Street Beach - South	2	X						
Lee Street Beach - North	2			X	X	X		
Elliot Park - South	3	X	X					X
Elliot Park - North	2							
Dempster Launch Facility	4		X					X
Dempster Beach	2				X			X
Greenwood Beach - North	4	X			X		X	
Dawes Park	2							
Church Street Launch Ramp	1							X
Dog Beach	2							
Clark Street Beach	2		X					
Lighthouse Beach	2				X		X	
Water Treatment Plant	2							

Garden Park

3. VULNERABILITY ASSESSMENT

The vulnerability of high water flood risk at each of the existing shoreline locations was assessed by defining the likelihood that the shoreline would be overtopped by high lake levels or wave runup. It compares the approximated top of shoreline protection elevation to the estimated 1% annual chance flood elevations, developed as part of FEMA's "Great Lakes Coastal Flood Study." The diagram below shows the relationship between these elevations. Extreme low water levels can cause vulnerability in specific structures, but those structures are not found on Evanston's shoreline. High water levels were studied only.



Freeboard is calculated by finding the difference between the top of shoreline protection elevation and 1% annual chance of wave runup and still water elevations. Freeboard calculations are divided into categories in the tables below. Category 1 has the least likely chance of overtopping while category 4/5 (respectively) has the highest likelihood to overtop shoreline protection. Categories 3 through 5 (highlighted in red) in the wave runup table below indicate the shoreline protection elevation is below the water surface elevation.

FREEBOARD = TOP OF SHORELINE PROTECTION ELEVATION - WAVE RUNUP - STILL WATER ELEVATION

Note: The greater category number between table 2a and 2b is used in the 'Likelihood' column in Table 3.

Table 2a: 1% Annual Chance Wave Runup

FREEBOARD	CATEGORY
Greater than 1 foot	1
1 to -1 feet	2
-1 to -3 feet	3
-3 to -5 feet	4
Below -5 feet	5

Table 2b: 1% Annual Chance Still Water

FREEBOARD	CATEGORY
6 feet or greater	1
4 to 6 feet	2
4 to 6 feet	3
Less than 2 feet	4

4. PRIORITIZATION

In addition to the condition and likelihood ratings, a level of importance or "usage" rating for each site was provided by the City of Evanston. Usage ratings were determined by Public Works Agency and Parks and Recreation staff representing several City functions, and provide a measure of criticality based on type of infrastructure being protected, as well as frequency and intensity of use. A usage rating of 5 is most critical with high use. The usage ratings are provided in the summary table below.

An overall weighted ranking was calculated by adding the condition rating (weighted with a factor of 0.5), with likelihood and usage ratings (each weighted with a factor of 0.25). The overall weighted rankings are shown in Table 3 below and the map on the following pages.

$$\text{Overall Ranking} = (\text{Condition}) \times 0.5 + (\text{Likelihood}) \times 0.25 + (\text{Usage}) \times 0.25$$

Table 3: Overall Weighted Ranking Summary

PARK NAME	SHORELINE TYPE	CONDITION (50%)	USAGE (25%)	LIKELIHOOD (25%)	OVERALL RANKING
Greenwood Beach - North	Beach	4	5	2	3.8
Elliot Park - South	Revetment	3	4	5	3.8
Dempster Launch Facility	Revetment	4	4	3	3.8
Garden Park - North	Revetment	4	2	4	3.5
Sheridan Road Revetment	Revetment	3	5	3	3.5
Clark Square	Revetment	3	2	4	3.0
Dempster Beach	Beach	2	5	3	3.0
Water Treatment Plant	Wall	2	5	3	3.0
South Boulevard Beach - North	Revetment	2	2	4	2.5
Garden Park - South	Revetment	2	2	4	2.5
Lee Street Beach - South	Revetment	2	3	3	2.5
Lee Street Beach - North	Wall	2	3	3	2.5
Elliot Park - North	Revetment	2	3	3	2.5
Dog Beach	Revetment	2	4	2	2.5
Clark Street Beach	Beach	2	3	3	2.5
Lighthouse Beach	Beach	2	4	2	2.5
Church Street Launch Ramp	Wall	1	5	3	2.5
South Boulevard Beach - South	Beach	2	2	3	2.3
Dawes Park	Revetment	2	3	2	2.3

MOST CRITICAL

LEAST CRITICAL


LEGEND
OVERALL WEIGHTED RATING
3.5 - 4.0
3.0 - 3.4
2.5 - 2.9
2.0 - 2.4
1.0 - 1.9
Property line between private and COE owned lakefront property
COE
City of Evanston owned lakefront property
CITY LIMITS
NORTH
COE
LIGHTHOUSE BEACH
COE
WATER TREATMENT PLANT
CLARK STREET BEACH
DOG BEACH
CHURCH STREET LAUNCH RAMP
DAWES PARK
GREENWOOD STREET BEACH NORTH
DEMPSTER BEACH
DEMPSTER LAUNCH FACILITY
ELLIOT PARK NORTH
ELLIOT PARK SOUTH
LEE STREET BEACH NORTH
LEE STREET BEACH SOUTH
COE
COE
CLARK SQUARE
GARDEN PARK NORTH
GARDEN PARK SOUTH
SOUTH BOULEVARD BEACH NORTH
SOUTH BOULEVARD BEACH SOUTH
COE
SHERIDAN ROAD REVETMENT
CITY LIMITS

SHERIDAN ROAD REVETMENT

Individual stones in the revetment have deteriorated, disintegrated, or been dislodged leaving gaps in the crest, which allow waves to reach Sheridan Road during storms.

SOUTH BOULEVARD BEACH

Significant erosion has occurred at South Boulevard Beach resulting in exposed cobble and rubble.

GARDEN PARK

Waves overtop the narrow revetment at the north end of Garden Park, causing damage on the landside.

CLARK SQUARE

The gabions (stone-filled wire baskets) behind the armor stone and sheetpile are deteriorating, and overtopping water washes the smaller stone into the park and causes erosion.

LEE STREET BEACH

The concrete wall and gabions have been exposed at the north end of Lee Street Beach, where there is very little dry beach width. The gabions are in poor condition, with several broken wire baskets.

ELLIOT PARK - SOUTH

The revetment at Elliot Park is in poor condition, with a low, narrow crest and several examples of disintegrated stone fragments, which are easily dislodged during storms.

ELLIOT PARK - SOUTH

Waves overtopping revetment has caused erosion along the edge of the park and undermines stability of the revetment.

ELLIOT PARK - NORTH

Revetment is steep and many stones appear unstable.

DEMPSTER STREET FACILITY

Dunes have deteriorated and substantial amounts of sand has been transported towards the Launch Facility

GREENWOOD BEACH

Revetment protecting the bathroom building at Greenwood Beach has reached the end of it's useful life. Armor stone has deteriorated and been displaced.

DAWES PARK

At the northern end of Dawes Park the revetment crest is relatively wide and the individual stones in reasonable condition. However, the crest here is lower than in other parts of the system.

CHURCH STREET LAUNCH RAMP

Significant sand build up at the boat launch ramp and driveway.

DOG BEACH

Revetment stone has been augmented with smaller pieces of broken concrete. There appear to be significant gaps between the revetment stones.

CLARK STREET BEACH

Sand displacement has caused low spots on the beach for water to collect as well as higher elevation dune features. This is a common phenomenon at wider beaches in the area (for example Montrose Beach in Chicago)

LIGHTHOUSE BEACH

Significant stone and gravel buildup was present at the lower portion of beach profile

5. URGENT NEEDS

Engineering judgment based on the results of the vulnerability assessment in combination with City of Evanston input was utilized to understand the types of vulnerabilities, frequency of use, and impact of loss of use of the area immediately adjacent to the shoreline to determine the Overall Weighted Rating. All sites with an overall weighted rating of 3 or greater were evaluated to determine feasibility of implementing short-term repairs.

From this evaluation, 5 urgent needs sites have been identified along the Evanston shoreline as requiring immediate repair to protect both accessibility and functionality of the shoreline.

1. GREENWOOD BEACH – NORTH
2. ELLIOT PARK – SOUTH
3. DEMPSTER LAUNCH FACILITY
4. GARDEN PARK – NORTH
5. SHERIDAN ROAD REVETMENT

GREENWOOD STREET BEACH - NORTH:

Condition: Narrow dry beach width with a relatively steep beach profile above the water line. Significant bluff damage with a near vertical scoured slope, above head high, with scattered large stone lakeward of the bluff. Cobble and gravel size material are also present near the water line. Scoured bluff presents a potential safety concern to pedestrian in the vicinity of the toe of slope. Low beach crest and width can be easily overtopped during storm events.

- Recommendation – Revetment stabilization and temporary flood barriers
  - Stabilize and add new armor stone to the revetment immediately in front of the building.
  - Install temporary flood protection (e.g. "TrapBag" barriers) extending south from revetment to limit overtopping damage, and reduce wind-blown sand transport.

In the future, consider dune establishment and/or permanent barrier to reduce overtopping at the beach, and new structure north of the beach to hold larger beach.

ELLIOT PARK – SOUTH :

Condition: Loss of stone on slope and at the top of bank resulting in significant overtopping of the shoreline and flooding of the adjacent park and facilities. Overtopping results in erosion of the landward side of the revetment, transport of sand and other debris into the adjacent park facilities and ponding of water in large portions of the park. Scour at the landward limit of the revetment has the potential to undermine the revetment while the other impacts of overtopping present a maintenance and potential safety concern to park users.

- Recommendation – Revetment stabilization and temporary flood barriers
  - Stabilize existing armor stone above the water line
  - Install temporary flood protection (e.g. "TrapBag" barriers) extending from north end of Lee Street Beach to approx. mid-point of Elliot Park

In the future, full revetment rehabilitation likely required.

DEMPSTER STREET LAUNCH FACILITY:

Condition: Loss of stone on slope and at the top of bank resulting in significant overtopping of the shoreline and flooding of the adjacent park and facilities. Overtopping results in transport of sand and other debris into driveway and the potential of flooding operations facilities existing for lower frequency storm events.

- Recommendation – Revetment Rehabilitation
  - Place armor stone on top of the underlayer along the slope as well as at the top of bank
  - Increase the height of the top of bank protection
  - Establish slopes of 2:1 or flatter

GARDEN PARK – NORTH:

Condition: Loss of stone on slope and lack of top of bank protection resulting in steepened shoreline profile and the potential for significant and frequent overtopping at north end of the park. Erosion to vegetated areas landward of the existing revetment have occurred exposing the presence of a sheet pile wall landward of the existing revetment. Overtopping during storm events presents a potential for frequent repair of vegetated space landward of the shoreline.

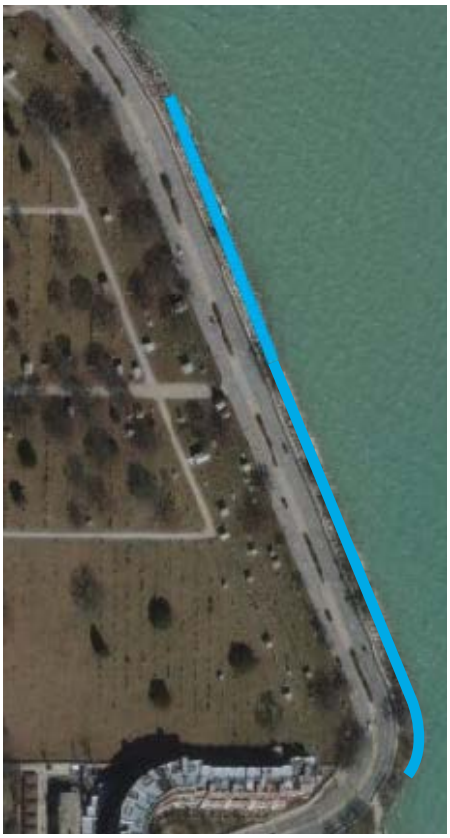
- Recommendation – Revetment Rehabilitation (Northern Portion)
  - Place new armor stone and underlayer on the land side to increase the height and width of the revetment crest.

SHERIDAN ROAD REVETMENT:

Condition: Loss of stone on slope and at the top of bank resulting in significant overtopping of the shoreline and exposure of erodible materials. Shoreline is subject to further erosion which may present a risk to roadway stability if erosion continues. Overtopping during storm events presents a potential safety risk to motorists and pedestrians that utilize the sidewalks and roadway immediately adjacent to the shoreline.

- Recommendation – Revetment Rehabilitation:
  - Fill gaps in existing protection along the slope and top of bank with smaller stone to establish an underlayer
  - Place of armor stone on top of the underlayer
  - Establish slopes of 2:1 or flatter.

Note: This portion of Sheridan Road is under IDOT jurisdiction. Recommend entering dialogue with IDOT to schedule revetment rehabilitation. Consider temporary flood barriers if water levels remain elevated and rehabilitation is delayed.



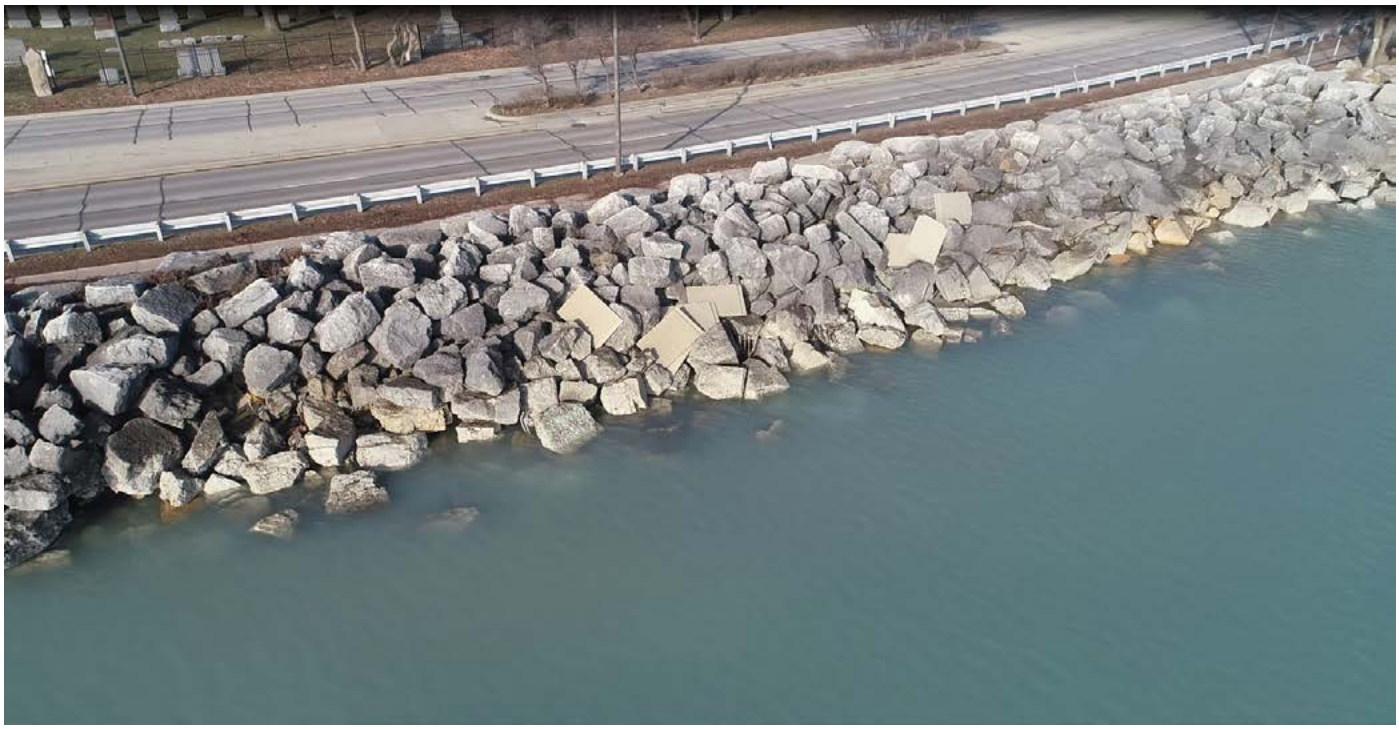


Table 4: Urgent Needs Implementation

PRIORITY	LOCATION	REVETMENT STABILIZATION AND REPAIR	TEMPORARY FLOOD PROTECTION
1	Greenwood Beach North	Regrade slope, add armor stone, and stabilize revetment at restroom, 100LF	Install temporary flood barriers, 400 LF
2	Elliot Park South	Stabilize armor stone revetment, 500LF	Install temporary flood barriers, 550 LF
3	Dempster St. Launch Facility	Rehabilitate revetment with new armor stone, 100 LF	N/A
4	Garden Park North	Rehabilitate revetment with new armor stone, 120 LF	N/A
5	Sheridan Road	Stabilize revetment and add new armor stone (full length). [Note: In discussion with IDOT, no 2020 work anticipated]	TBD

Figure 1-1 Erosion at Greenwood Beach (March 2020)

Figure 1-2 Flooding at Elliot Park (April 2020)

Of the 5 sites identified, Greenwood Beach and Elliot Park in particular, are experiencing critical public safety and degradation issues. As seen in the images below, the revetment at Greenwood Beach has been severely eroded and Elliot Park is experiencing significant flooding and damage to its revetment. In addition to some revetment rehabilitation in critical areas, easily deployable, temporary flood barriers are warranted as a short-term solution to reduce further erosion, flooding, and damage to the shoreline. The barriers are recommended to be put in place for 1-2 seasons until lake levels are lower and the City is able to implement long-term and more permanent protections

6. FUTURE SHORELINE IMPROVEMENTS

The most urgent needs that were identified during the assessment and prioritization process have begun to be addressed through procurement of shoreline improvements and temporary flood protection (Public Bid 20-36). This section describes potential interventions to be considered in the medium-term (approximately 2021-2025), which build from Goal 1 of the City's Lakefront Master Plan: "Establish practices and policies to preserve and enhance the lakefront's natural environment". For the purposes of evaluation these interventions were grouped into the following three categories:

TYPE 1: TEMPORARY AND/OR NON-CAPITAL INTENSIVE IMPROVEMENTS

- Solutions related to temporary and/or long-term changes in operations;
- Modified and/or new maintenance activities; and
- Installation of temporary features (e.g. flood protection barriers) that can reduce vulnerability until such time as permanent improvements can be implemented.

TYPE 2: CAPITAL – REHABILITATION OF EXISTING STRUCTURES

- Repair and rehabilitation of existing structures; and
- Enhancement of existing features (e.g. beach nourishment).

TYPE 3: CAPITAL – NEW STRUCTURES AND FEATURES

- Addition of new shore protection features;
- Addition of lakefront features to increase access and usage;
- Public engagement features (not specifically adding to shoreline protection, but enhancing public use of lakefront).

The following tables show a summary of the more suitable options for each site, along with options that could potentially be considered. Descriptions of the considered improvements follow the summary tables.

Table 5: Temporary and/or Non-capital intensive improvements

PARK NAME	SHORELINE TYPE	OVERALL RANKING	PROGRAM RELOCATION	TEMPORARY BARRIER	REVETMENT VEGETATION MANAGEMENT	DUNE MANAGEMENT	DUNE RESTORATION	TRAP BAG PLANTING
Greenwood Beach - North	Beach	3.8	-	●			●	◇
Elliot Park - South	Revetment	3.8		●	X			
Dempster Launch Facility	Revetment	3.8			X			
Garden Park - North	Revetment	3.5			X			
Sheridan Road Revetment	Revetment	3.5		◇	X			
Clark Square	Revetment	3.0		◇	X			◇
Dempster Beach	Beach	3.0		◇				
Water Treatment Plant	Wall	3.0		●				
South Boulevard Beach - North	Revetment	2.5			X		◇	●
Garden Park - South	Revetment	2.5			X			
Lee Street Beach - South	Revetment	2.5					●	◇
Lee Street Beach - North	Wall	2.5	+	◇	X		◇	●
Elliot Park - North	Revetment	2.5		●	X			
Dog Beach	Revetment	2.5			X			
Clark Street Beach	Beach	2.5	+		X	●		◇
Lighthouse Beach	Beach	2.5				●		
Church Street Launch Ramp	Wall	2.5						
South Boulevard Beach - South	Beach	2.3	+				●	●
Dawes Park	Revetment	2.3			X		◇	◇

● SUITABLE ◇ POTENTIAL CONSIDERATION + ADD PROGRAM ELEMENT - REMOVE PROGRAM ELEMENT X CONTINUOUS PROGRAM ELEMENT

Table 6: Capital Shoreline Improvements – Rehabilitation of existing structures

PARK NAME	SHORELINE TYPE	OVERALL RANKING	TRAPBAG & CONCRETE	REVETMENT REHABILITATION	NEW RIP-RAP	BEACH NOURISHMENT	PERCHED BEACH	GEO-TUBE
Greenwood Beach - North	Beach	3.8		●	●		◇	◇
Elliot Park - South	Revetment	3.8		●				
Dempster Launch Facility	Revetment	3.8	◇	●				
Garden Park - North	Revetment	3.5	●	●				
Sheridan Road Revetment	Revetment	3.5	◇	●				
Clark Square	Revetment	3.0	●	●				
Dempster Beach	Beach	3.0				◇		
Water Treatment Plant	Wall	3.0	●	●				
South Boulevard Beach - North	Revetment	2.5		●				
Garden Park - South	Revetment	2.5		●				
Lee Street Beach - South	Revetment	2.5			●			
Lee Street Beach - North	Wall	2.5			●		◇	◇
Elliot Park - North	Revetment	2.5		●				
Dog Beach	Revetment	2.5	●	●		◇		◇
Clark Street Beach	Beach	2.5	●					
Lighthouse Beach	Beach	2.5						
Church Street Launch Ramp	Wall	2.5						
South Boulevard Beach - South	Beach	2.3						
Dawes Park	Revetment	2.3		●				

● SUITABLE ◇ POTENTIAL CONSIDERATION

Table 7: Capital Shoreline Improvements – New structures and features

PARK NAME	SHORELINE TYPE	OVERALL RANKING	HEADLAND	GROIN	ENGAGEMENT FEATURE	BOARDWALK RAMP	SEAWALL ACCESS
Greenwood Beach - North	Beach	3.8	●	●			◇
Elliot Park - South	Revetment	3.8		◇	◇	◇	
Dempster Launch Facility	Revetment	3.8					
Garden Park - North	Revetment	3.5			◇	◇	
Sheridan Road Revetment	Revetment	3.5			◇		
Clark Square	Revetment	3.0			◇	◇	
Dempster Beach	Beach	3.0		◇			
Water Treatment Plant	Wall	3.0					
South Boulevard Beach - North	Revetment	2.5			◇	◇	◇
Garden Park - South	Revetment	2.5					◇
Lee Street Beach - South	Revetment	2.5			◇	◇	
Lee Street Beach - North	Wall	2.5	◇				
Elliot Park - North	Revetment	2.5	◇		◇	◇	
Dog Beach	Revetment	2.5				◇	◇
Clark Street Beach	Beach	2.5			●	◇	◇
Lighthouse Beach	Beach	2.5			◇	◇	
Church Street Launch Ramp	Wall	2.5			●		
South Boulevard Beach - South	Beach	2.3	◇	◇	◇	◇	
Dawes Park	Revetment	2.3		●	◇	◇	◇

● SUITABLE ◇ POTENTIAL CONSIDERATION

7. POTENTIAL IMPROVEMENT TYPOLOGIES

PROGRAM RELOCATION:

This option is useful as either a temporary or permanent non-capital option, and involves activating other (better protected) areas of the lakefront for programmed or individual recreation. For example, some beaches offer greater recreation space during periods of high water or until more permanent shore protection measures can be implemented. Generally, this option needs to be considered in conjunction with public education and messaging, and some degree of change management to help for a smooth transition.

TEMPORARY BARRIER:

Deploying pre-stocked barriers (typically concrete "Jersey" barriers) in areas that are away from direct wave attack but that can keep overtopping water away from critical infrastructure is a common seasonal operation that can be utilized during periods of high water, or until more permanent shore protection measures can be implemented.

Image 7-2 Temporary Concrete barriers at 67th Street, Chicago

TRAPBAG WITH PLANTINGS:

Image 7-1: Trapbag - Sand-filled & Planted

"TrapBag" (with planting): There are several proprietary products that can be deployed by public works staff and/or community volunteers that provide a semi-permanent barrier against wave run up and erosion. Some of the systems allow for supplemental planting to increase resiliency. "TrapBag" is one such product, that comprises fabric cells which can be filled with sand or other material. Multiple heights are available (2-, 4-, and 6-foot).

TYPE 1: TEMPORARY AND/OR NON-CAPITAL INTENSIVE

HABITAT OBSERVATION & EDUCATION

Image 7-3 (credit Shedd Aquarium): Habitat Restoration

Increased natural habitat areas allow for habitat observation and education opportunities along the Lakefront. The habitat area would need a large, connected space to flourish, avoiding small patch habitats separated from one another. Crowd control measures will help create and sustain a biodiverse habitat. From the 2008 Lakeshore Master Plan, the community was in favor of more educational programming along Lake Michigan.

BEACH SIGNAGE:

As implementation begins along the lakeshore, signage will be necessary to communicate the ongoing efforts to the public. A cohesive lakeshore-wide signage program introduces an opportunity to teach the community about the Great Lakes, natural habitats, and observable annual changes.

Image 7-4: Beach Management Signage

DUNE MANAGEMENT:

Areas such as Lighthouse Beach where successful dune restoration has taken place are demonstrating greater resiliency, as well as increased habitat value. Dunes that are populated with well-adapted native grasses will recover more quickly from storm damage and help to accrete sand that will become sacrificial protection against future storms. A simple technique to help preserve existing dunes is to restrict unfettered public access through the use of signage and simple rope barriers. Dune restoration can be implemented at dune areas without existing vegetation. A small scale restoration with volunteers or stewardship opportunities would be considered non-capital, while a major restoration would be a capital improvement.

TRAPBAG (CONCRETE FILLED):

A "TrapBag" filled with concrete is able to withstand more energetic wave attacks, in comparison to being filled with sand and planted as described in non-capital improvements.

Image 7-5: Trapbag - Concrete Filled

ARMOR STONE REVETMENT REPAIR:

Armor Stone Revetment Rehabilitation: Rebuilding the existing revetments to a thicker and flatter revetment provides a more dissipative structure along the shoreline to reduce wave runup and overtopping. The existing revetment can be made more robust by adding underlayer and armor stone to a flatter slope, extending lakeward from the existing crest, and restoring crest widths and heights.

Image 7-6: Revetment Rehabilitation

NEW RIP-RAP:

New Rip-Rap: Installing new rip-rap at sites without a revetment would stabilize the shoreline in an area which shows active erosion. This serves to hold the shoreline in it's current position, but requires consideration for access to the waterfront, views and safety for pedestrians. New stone is placed along the slope in a 2-layer system to dissipate wave energy that causes erosion and to a height to limit wave runup and overtopping.

LIVE-STAKE DUNE RESTORATION:

A large scale dune restoration including live staking woody plants and grasses will significantly lengthen the life of the dune and improve its ability to fight wave energy. Rope fencing and signage to the public is important in the early stages of the vegetation planting.

Image 7-7: Large Scale Dune Restoration

TYPE 2: CAPITAL – REHABILITATION OF EXISTING STRUCTURES

BEACH NOURISHMENT:

Importation and placement of sand to create a natural buffer and recreational amenity along the shoreline. Typically, placed at areas with existing beach, but also can be used to raise elevations of beaches submerged by high waters. Short to near term protection of the shoreline as wave action and high waters transport sediment.

Image 7-8: Beach Nourishment Process

PERCHED BEACH:

Similar to Beach Nourishment involving the importation and placement of sand, but also includes a structural sill or toe at the lakeward limit of placement to allow for the beach to be raised to a desired elevation over a shorter cross-shore distance.

GEOTUBE GEOSYNTHETIC:

Geotube: Geosynthetic, non-permeable structure often constructed of tubular cells connected together to form a shore stabilization structure. They can be filled with sand and have multiple applications such as groin structures, buried seawalls, sills, or breakwaters. They are susceptible to damage due to Ultraviolet exposure or cuts and abrasion. When used in short term stabilization, geotubes can be removed and sand filled left in place to nourish the shoreline.

HEADLAND:

Short protruding structure that protects pocket beach from direct wave attack.

Image 7-9: Headland

SEAWALL:

Some communities have utilized larger, more robust shore protection facilities (e.g. around the Shedd Aquarium in Chicago), which offer protection from storm damage as well as proximity to the water's edge.

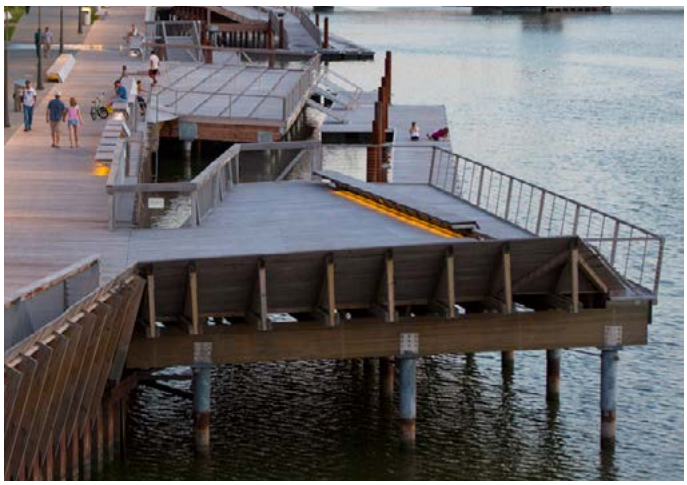
Image 7-10: Seawall

GROIN:

Shore perpendicular structures (typically stone or sheet pile) that help to slow down littoral transport.

OVERLOOK PIER:

Additional local points of entry to the beach area with a boardwalk will increase a sense of accessibility to the waterfront. This will be especially important as barriers become taller to protect the shoreline.



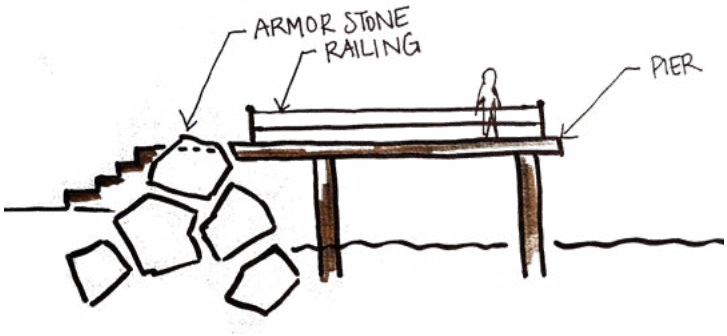
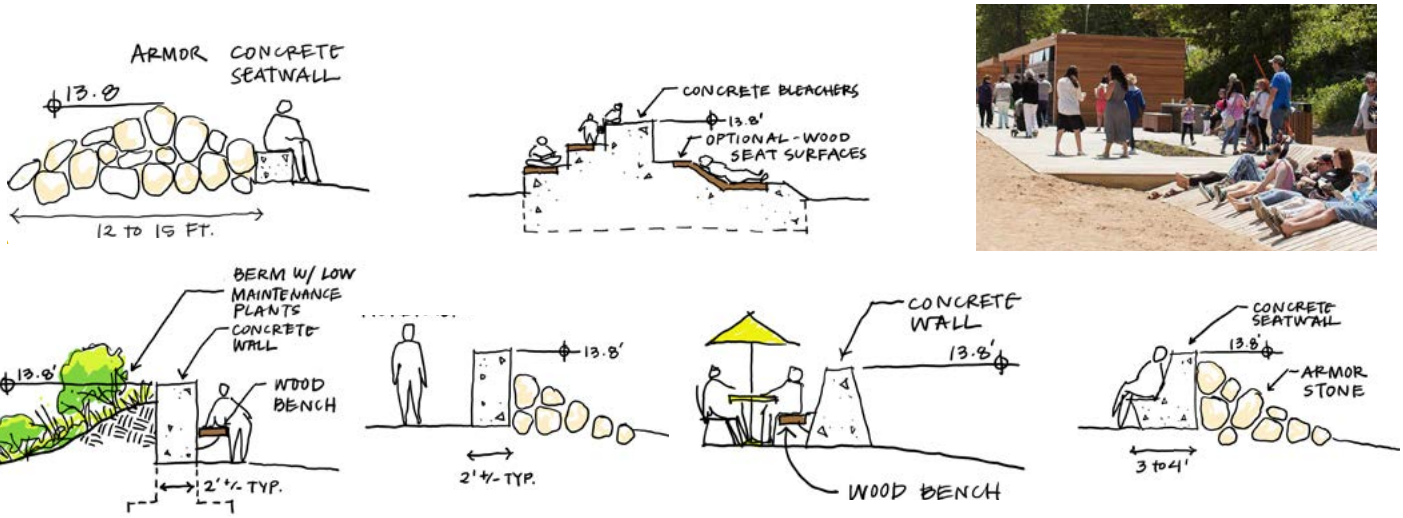


Image 7-11: Overlook Structure

TYPE 3: CAPITAL– NEW STRUCTURES AND FEATURES

BEACH SEATING & PAVILION:

Seating and shaded areas to rest can be built into the shoreline protection measures and become an asset to the parks or beaches.



Images 7-12: Seat wall configurations

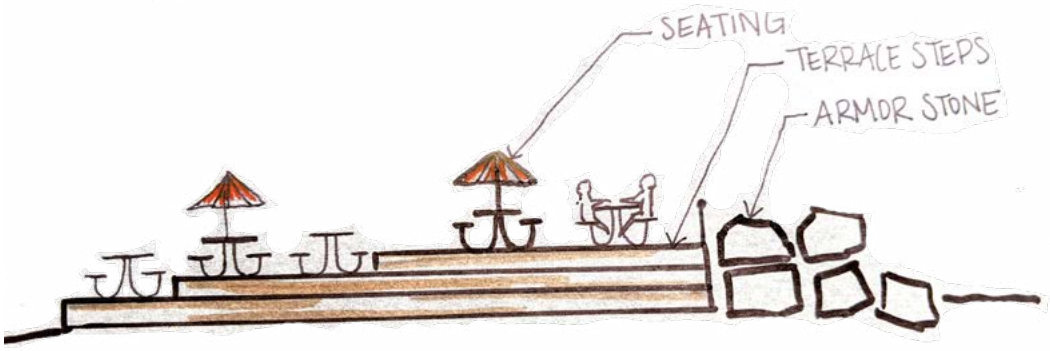
PLAY ON BARRIER:

The edge made by sloped dunes and tall armor stone create an opportunity to incorporate in play activities without creating an entire playground. A low rope climb nestled in sand and vegetation creates an informal place for nature discovery. A slide tucked within the armor stone creates surprise and wonder when it's discovered. Studies would need to be conducted to determine safety precautions and best locations.

Images 7-13 (credit Go Green Copenhagen, New York Times): Example play elements

PICNIC TERRACE:

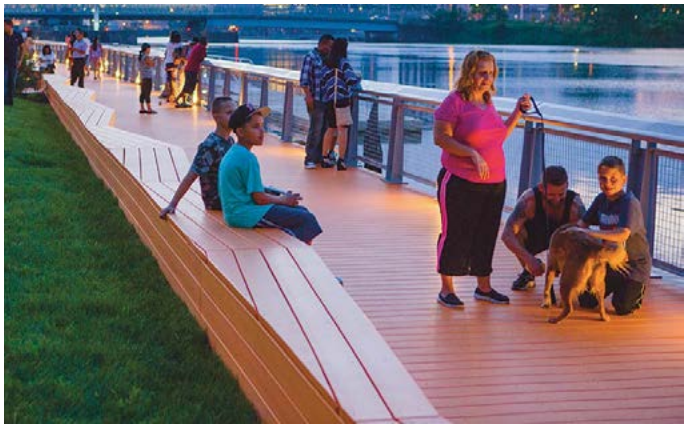
Building up elevation with picnic terraces is another way to visually engage the community with the waterfront while also providing a memorable amenity.

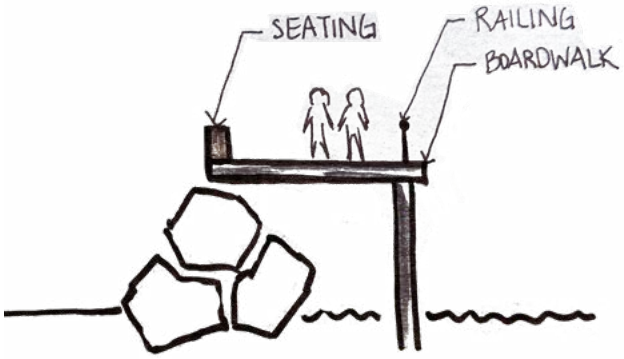


Images 7-14: Picnic terrace

BOARDWALK:

This element to the lakefront invites people who aren't comfortable swimming to experience being on the water. The materials used would need to be able to handle the freeze/thaw cycle of the Midwest or be a temporary style that can be easily removed and stored annually.





Images 7-15: Permanent boardwalk

TYPE 3: CAPITAL– NEW STRUCTURES AND FEATURES (CONTINUED)

8. CAPITAL INVESTMENT PLAN

The table below categorizes each site into Groups. Group 1 represents projects that should be considered in the near term while Group 5 captures sites to be planned for in the long term. A potential implementation schedule (funding dependent) is shown for each group. In some cases, lower priority park segments are grouped together with a neighboring, higher ranking segment for implementation efficiency. The most urgent needs that were identified during the assessment, except the Sheridan Road Revetment as coordination with IDOT is needed, are scheduled to be completed in 2020 and are represented in the urgent needs column in the table below.

Table 8: Capital Investment Table

PARK NAME	SHORELINE TYPE	OVERALL RANKING	URGENT NEEDS*	GROUP 1	GROUP 2	GROUP 3	GROUP 4	GROUP 5
Greenwood Beach - North	Beach	3.8	$206,500		$3,360,000			
Elliot Park - South	Revetment	3.8	$188,900	$1,688,000				
Dempster Launch Facility	Revetment	3.8	$214,800					
Garden Park - North	Revetment	3.5	$136,200					
Sheridan Road Revetment	Revetment	3.5	N/A	$3,375,000				
Clark Square	Revetment	3.0				$1,575,000		
Dempster Beach	Beach	3.0			$920,000			
Water Treatment Plant	Wall	3.0				$220,000		
South Boulevard Beach - North	Revetment	2.5					$1,238,000	
Garden Park - South	Revetment	2.5					$563,000	
Lee Street Beach - South	Revetment	2.5				$200,000		
Lee Street Beach - North	Wall	2.5				$403,000		
Elliot Park - North	Revetment	2.5		$1,688,000				
Dog Beach	Revetment	2.5						$1,988,000
Clark Street Beach	Beach	2.5						$540,000
Lighthouse Beach	Beach	2.5					$225,000	
Church Street Launch Ramp	Wall	2.5						$338,000
South Boulevard Beach - South	Beach	2.3					$360,000	
Dawes Park	Revetment	2.3						$900,000
			2020	2021-23	2023-24	2025-26	2027-28	2029-30

The following pages detail estimated cost ranges (2020 price level, excluding "soft" costs) for each group are listed, along with a brief description of the suggested improvement and potential park enhancements. Groupings are recommended based on priority and geography and extend over a 12 year period.

* Urgent needs costs are based on Shoreline Improvements contract approved by City Council on August, 10, 2020

NOTES ON ESTIMATED COSTS

Estimated costs are given per group. Each group estimate does not include soft costs such as engineering, design, permitting, construction administration, or bond payments. Costs are calculated based on linear footage of recommended repairs based on 2020 information. For budgeting purposes, the additional public space enhancements could be estimated at $250,000 per enhancement (individual costs will vary). Assuming one public enhancement is budgeted for each site, the total additional construction cost would be approximately $4 million. Costs on the previous pages do not take potential partnerships into consideration.

Cost ranges are based on the following criteria:

- Low End: Completing larger sections of repairs at once will drive down the linear foot costs. For example, completing an entire section of revetment rehabilitation at once will bring down costs when compared to completing one half one year and the other half the following year.
- Mid Range: This cost is calculated using current bid pricing information.
- High End: Many factors including scope increase, material price volatility, and the potential for including agency-mandated requirements from the permit process have the potential to drive up costs.

GROUP 1

TOTAL COST FOR GROUP 1:
Low: $5,063,250
Mid: $6,751,000
High: $10,126,500

*Costs to be refined as project design and scope advance.

NORTH

ELLIOT PARK

$3,376,000

Revetment rehabilitation for entirety of Elliot Park (North & South), approx. 1,500 LF

Public Space Enhancements:

Plan for (1) enhancement, suitable options include a boardwalk, overlook, beach seating, or play feature.

ELLIOT PARK

SHERIDAN ROAD REVETMENT

$3,375,000

Revetment rehabilitation (Potential for cost- share arrangement with IDOT), Approx. 1,500 LF

Public Space Enhancements:

Plan for (1) enhancement, such as lakefront trail improvements.

SHERIDAN ROAD REVETMENT

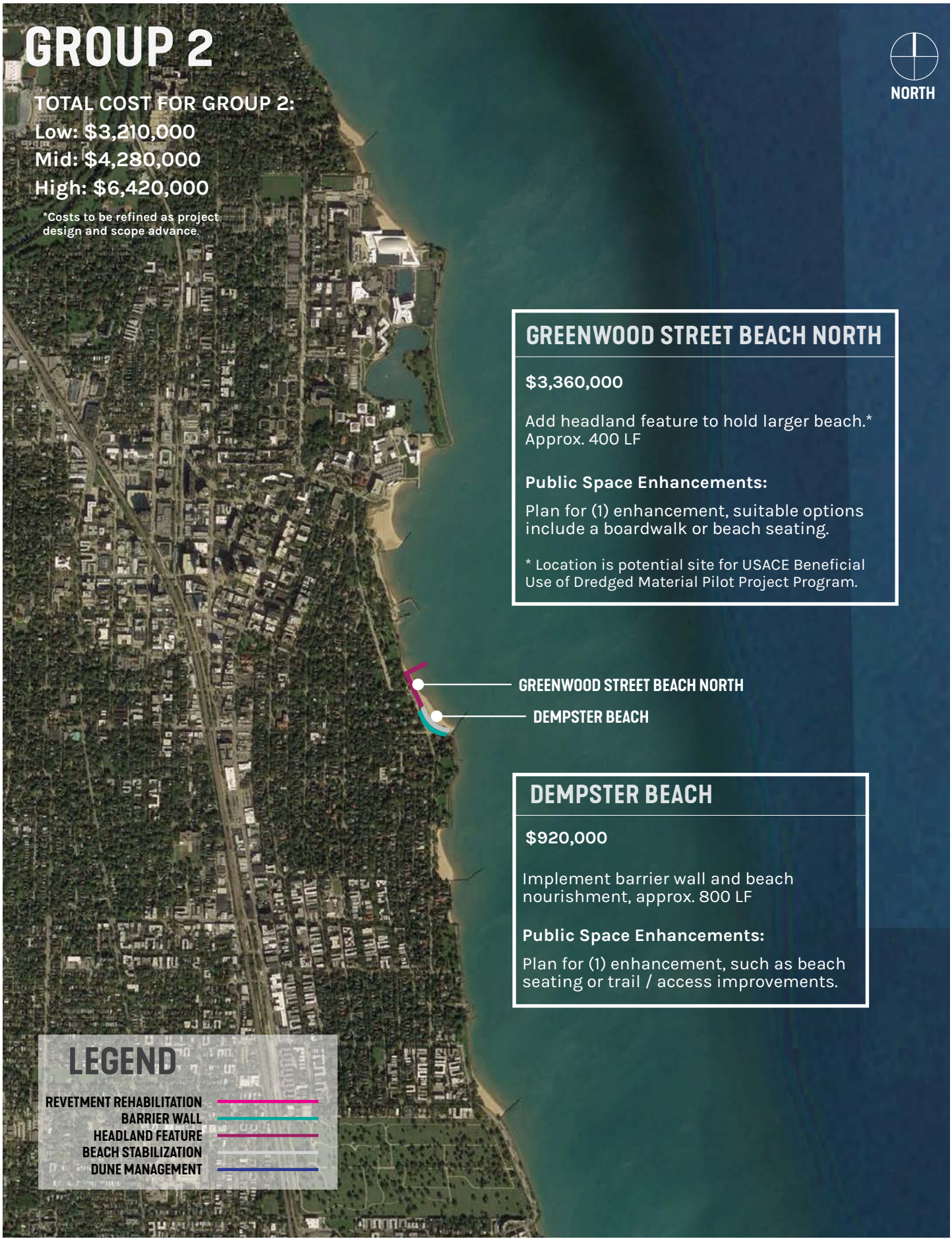
LEGEND

- REVETMENT REHABILITATION
- BARRIER WALL
- HEADLAND FEATURE
- BEACH STABILIZATION
- DUNE MANAGEMENT

GROUP 2

TOTAL COST FOR GROUP 2:
Low: $3,210,000
Mid: $4,280,000
High: $6,420,000

*Costs to be refined as project design and scope advance.



GREENWOOD STREET BEACH NORTH

$3,360,000

Add headland feature to hold larger beach.* Approx. 400 LF

Public Space Enhancements:

Plan for (1) enhancement, suitable options include a boardwalk or beach seating.

* Location is potential site for USACE Beneficial Use of Dredged Material Pilot Project Program.

DEMPSTER BEACH

$920,000

Implement barrier wall and beach nourishment, approx. 800 LF

Public Space Enhancements:

Plan for (1) enhancement, such as beach seating or trail / access improvements.

GROUP 3

TOTAL COST FOR GROUP 3:
Low: $1,798,500
Mid: $2,398,000
High: $3,597,000

*Costs to be refined as project design and scope advance.

WATER TREATMENT PLANT

$220,000

Implement barrier wall, approx. 500 LF

Public Space Enhancements:

This site is not accessible to the public (but might support ecological enhancements).

LEE STREET BEACH

$603,000

Beach stabilization and protection, approx. 850 LF.*

Public Space Enhancements:

Plan for (1) enhancement, but many options are suitable such as beach seating, play feature, picnic terrace, or overlook.

* Location is potential site for USACE Beneficial Use of Dredged Material Pilot Project Program.

CLARK SQUARE

$1,575,000

Revetment rehabilitation, approx. 700 LF

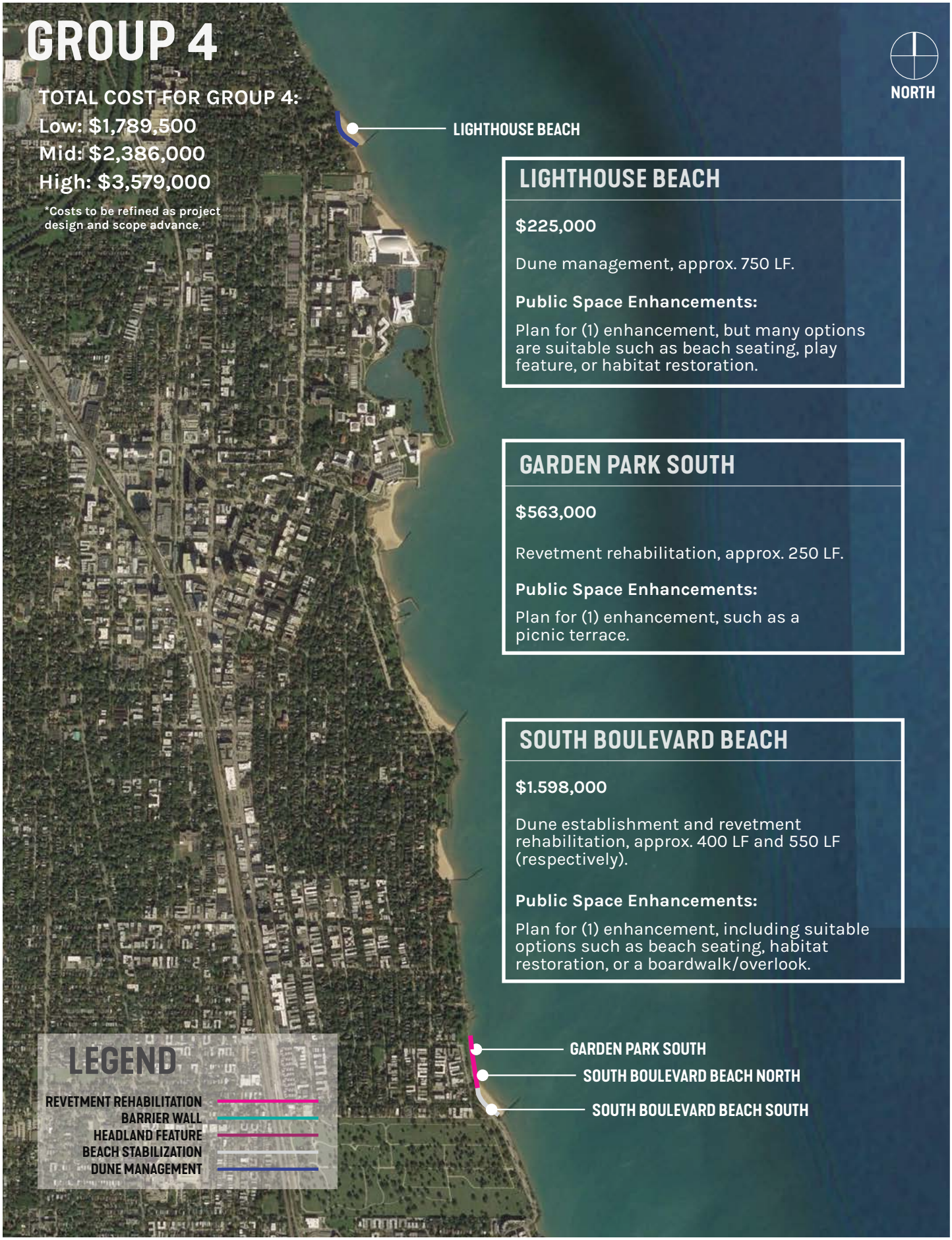
Public Space Enhancements:

Plan for (1) enhancement, such as a picnic terrace or boardwalk.

GROUP 4

TOTAL COST FOR GROUP 4:
Low: $1,789,500
Mid: $2,386,000
High: $3,579,000

*Costs to be refined as project design and scope advance.



LIGHTHOUSE BEACH

$225,000

Dune management, approx. 750 LF.

Public Space Enhancements:

Plan for (1) enhancement, but many options are suitable such as beach seating, play feature, or habitat restoration.

GARDEN PARK SOUTH

$563,000

Revetment rehabilitation, approx. 250 LF.

Public Space Enhancements:

Plan for (1) enhancement, such as a picnic terrace.

SOUTH BOULEVARD BEACH

$1.598,000

Dune establishment and revetment rehabilitation, approx. 400 LF and 550 LF (respectively).

Public Space Enhancements:

Plan for (1) enhancement, including suitable options such as beach seating, habitat restoration, or a boardwalk/overlook.

GROUP 5

TOTAL COST FOR GROUP 5:
Low: $2,824,500
Mid: $3,766,000
High: $5,649,000

*Costs to be refined as project design and scope advance.

NORTH

CLARK STREET BEACH

$540,000

Dune Management, 600 LF.

Public Space Enhancements:

Plan for (1) enhancement, such as beach seating or habitat restoration.

DOG BEACH

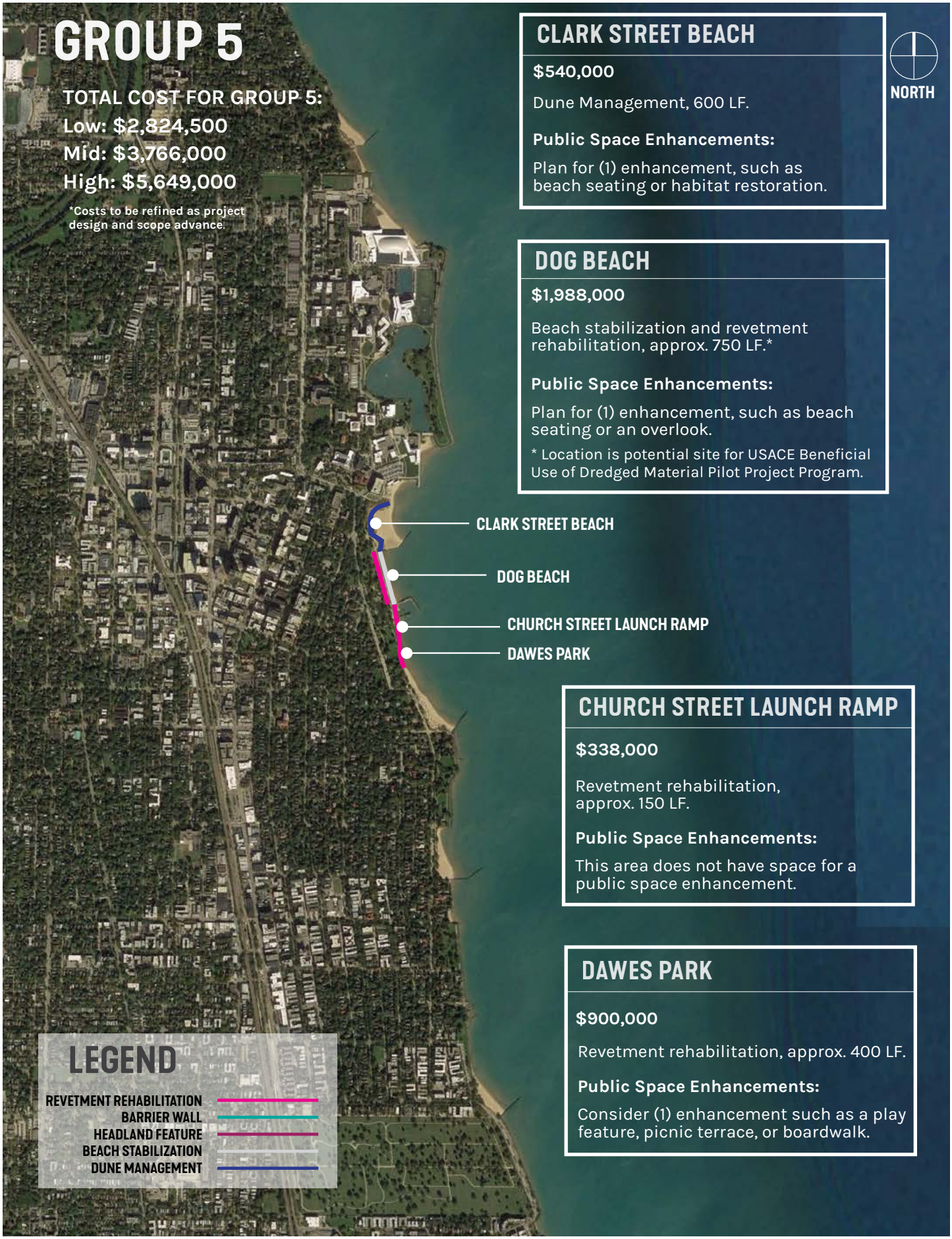
$1,988,000

Beach stabilization and revetment rehabilitation, approx. 750 LF.*

Public Space Enhancements:

Plan for (1) enhancement, such as beach seating or an overlook.

* Location is potential site for USACE Beneficial Use of Dredged Material Pilot Project Program.



CHURCH STREET LAUNCH RAMP

$338,000

Revetment rehabilitation, approx. 150 LF.

Public Space Enhancements:

This area does not have space for a public space enhancement.

DAWES PARK

$900,000

Revetment rehabilitation, approx. 400 LF.

Public Space Enhancements:

Consider (1) enhancement such as a play feature, picnic terrace, or boardwalk.

PARTNERSHIP OPPORTUNITIES

Given the position of Evanston's lakefront within the broader context of the nationally significant Great Lakes system, there are likely several potential partnership opportunities that may assist the City in embarking on a strategic program to address the capital improvement needs. While by no means exhaustive, the following sections describe some of the types of agencies and groups that could play a role in the long-term stewardship of the lakefront system.

FEDERAL

Funding Source	*Due Date*	*Suitable Sites*
■ FEMA Building Resilient Infrastructure and Communities (BRIC)	Opens Sep. 30	All sites are suitable
■ Coastal Management Grant Program	No Grants in 2020	All sites are suitable
■ Land and Water Conservation Fund	May 1	To be studied
■ Recreational Trails	May 1	To be studied
■ Sport Fish Restoration - Piers of Access	Feb. 1 or Oct. 1	To be studied
■ FEMA 406 Program	Rolling	Contingent on disaster declaration
■ Transportation Alternatives Program	January	To be studied
■ Boating Infrastructure Grant Program, Tier I or Tier II	June 1	To be studied
■ Clean Vessel Act	Rolling	To be studied

Funding Source	*Due Date*	*Suitable Sites*
STATE & LOCAL		
■ IDNR Open Space Lands Acquisition and Development Grant	June 1	All sites are suitable
■ IDNR Park and Recreational Facilities Construction Program	December 1	All sites are suitable
■ IDNR Boat Access Area Development Grant Program	October 2, 2020	Church Street Launch Ramp or Dempster Launch Facility
■ IDOT Surface Transportation		Sheridan Road
PHILANTHROPIC, ADVOCACY OR OTHER		
■ Great Lakes Protection Fund	Rolling	South Boulevard Beach, Lighthouse Beach, Greenwood Beach to be studied
■ NFWF National Coastal Resilience Fund		To be studied
■ MWRD Green Infrastructure Partnership Opportunity Program		To be studied
■ Joyce Foundation		To be studied
■ Alliance for the Great Lakes		To be studied
■ Chi-Cal Fund		To be studied

9. APPENDIX – SUMMARY OF EXISTING SHORELINE CONDITIONS

SHERIDAN ROAD

- Revetment slopes vary - starting out steep at the southern end, shallow in the middle and steep again at the northern end
- Crest protection is minimal at southern end and increases moving north with varying degrees of section loss throughout
- Crest stones are significantly larger than the rest of the stone in the revetment

Source: GIS

SHERIDAN ROAD

Image 1: Varying revetment slope

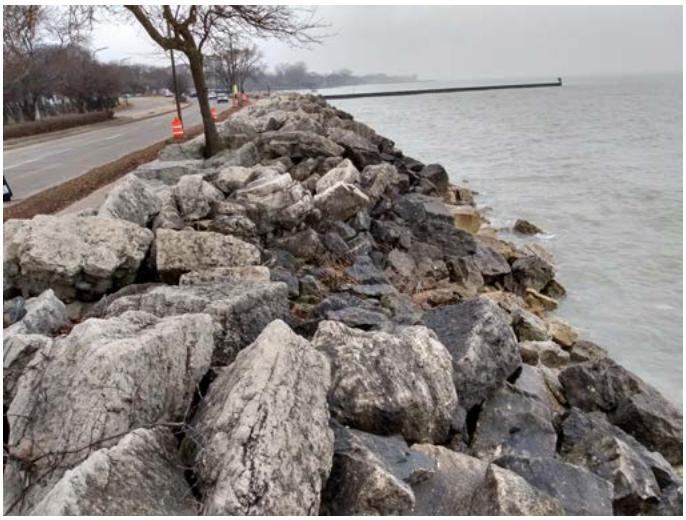


Image 2: Widening crest protection moving north

Image 3: Section loss in crest protection

Image 4: Varying stone sizes along revetment slope

SOUTH BOULEVARD BEACH

- Beach appeared to be in good condition with some stone and gravel buildup throughout
- Significant erosion was observed at embankment before transitioning to rock revetment
- Rock Revetment between beach and Garden Park has a 1 stone wide or no discernible crest

Source: GIS

SOUTH BOULEVARD BEACH

Image 1: Stone and gravel buildup on beach

Image 2: Significant erosion at embankment

GARDEN PARK

- Crest protection was only present along a portion of revetment
- Significant section loss and exposed underlayer were observed throughout revetment
- Erosion caused by overtopping/ stormwater was apparent on the backside of the revetment

Source: GIS

GARDEN PARK

Image 1: Varying width in crest protection

Image 3: Erosion and exposed sheet pile wall at back of revetment

Image 2: Exposed underlayer and section loss throughout revetment

CLARK SQUARE PARK

- Revetment stone appears to be stacked in front of wall at near vertical slope
- Some section loss was observed throughout revetment crest
- 1 layer of gabions visible on the back side of a steel sheet pile wall, several were damaged

Source: GIS

CLARK SQUARE PARK

Image 1: Revetment stone stacked at near vertical slope

Image 2: Section loss in revetment crest

Image 3: Damaged gabions on back side of sheet pile wall

LEE STREET BEACH

- Elevated beach profile was observed at the southern end of beach
- <2 feet of h-pile and concrete panel wall was exposed at north end where beach narrows
- Gabions at toe of exposed wall were damaged

Source: GIS

LEE STREET BEACH

Image 1: Lee Street Beach width

Image 2: Exposed h-pile and concrete wall

Image 3: Damaged gabions along wall

ELLIOT PARK

- Revetment crest varies from 5'+ in height to 2-3' moving north
- Revetment slopes were steep to near vertical with some noted displaced stone
- Significant landscape damage and erosion was observed on backside of revetment, previous flooding in park was noted by the City

Source: GIS

ELLIOT PARK

Image 1: Steep revetment slope

Image 2: Significant landscape damage and displaced stone

Image 3: Small stones covering beach

DEMPSTER STREET FACILITY

- Significant signs of sand transport into driveway from beach
- Minor flooding in building was noted by the City

Source: GIS

DEMPSTER STREET FACILITY

Image 1: Sand transport into driveway

Image 2: Sand transport into driveway

GREENWOOD BEACH

- Northern portion of beach is narrow with limited dry beach width and some gravel/stone buildup
- Large slope failure of bluff, approximately 7’ in height, was observed at northern limit of beach
- Larger stone was scattered in bluff and at toe of bluff slope failure

Source: GIS

GREENWOOD BEACH

Image 1: Gravel and stone buildup on beach

Image 2: Large slope failure with scattered stone

DAWES PARK

- Revetment crest at southern end of park was narrow or not apparent
- Revetment crest widens and becomes lower moving north

Source: GIS

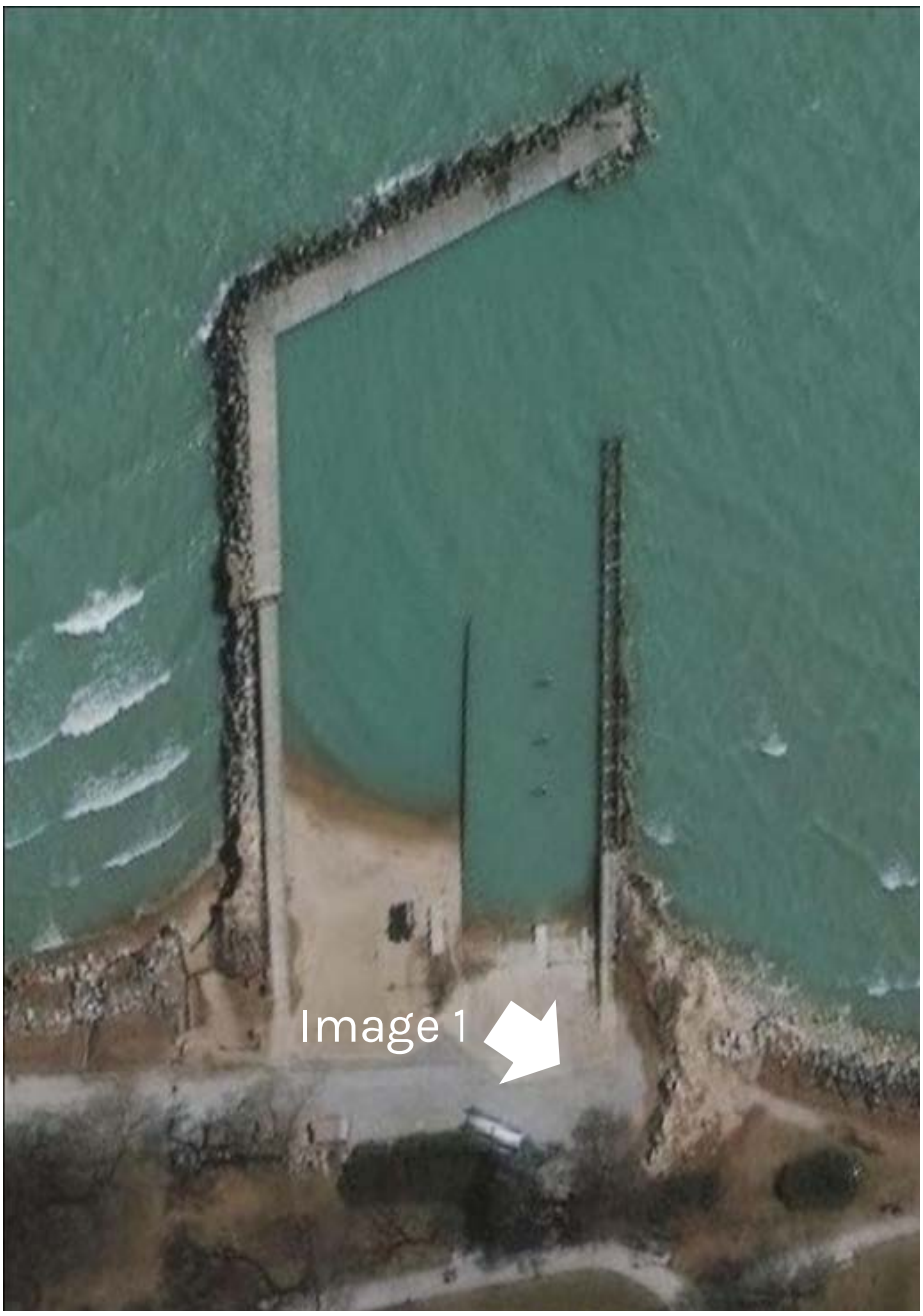
DAWES PARK

Image 1: No significant revetment crest

Image 2: Widening revetment crest

CHURCH STREET LAUNCH

- Significant sand buildup was observed on ramp and driveway



Source: GIS

CHURCH STREET LAUNCH

Image 1: Sand buildup at driveway

DOG BEACH

- Variable amount of stone was present at the revetment crest
- Section loss and exposed underlayer were observed in several locations along revetment slope
- Note: Beach area was submerged during inspection, and condition/ vulnerability refer to protective revetment, not condition of the actual beach.

Source: GIS

DOG BEACH

Image 1: Variable amount of stone at revetment crest

Image 2: Section loss and exposed underlayer

CLARK STREET BEACH

- Beach appeared to be in good condition overall
- Ponding was observed on the southern corner of the beach adjacent to steel sheet pile, source of water is unknown and does not dry

Source: GIS

CLARK STREET BEACH

Image 1: Beach in overall good condition

Image 2: Ponding observed at southern corner of beach

LIGHTHOUSE BEACH

- Marginal dry beach width was available, beach narrows moving north
- Significant stone and gravel buildup was present at lower portion of beach profile

Source: GIS

LIGHTHOUSE BEACH

Image 1: Marginal dry beach width

Image 2: Significant stone buildup and beach narrowing

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