PARK DISTRICT OF HIGHLAND PARK

BEACH MANAGEMENT PLAN

March 2021

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ACKNOWLEDGMENTS

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EXECUTIVE SUMMARY

This beach management plan provides recommendations for protecting and managing the Park District of Highland Park's beaches, bluffs, ravines, and other lakefront properties at Moraine Beach, Park Avenue Boating Facility, Millard Beach, and Rosewood Beach. The recommendations provided in this plan are based on an evaluation of the existing conditions found at the beaches, uses associated with the beach, and a review of lake and habitat conditions. The recommendations provided are specific to each beach.

The purposes of this plan are to:

1. Preserve and protect long-term access and use of the beaches, bluffs, ravines, and other lakefront properties

2. Establish guidance for responses to significant storm events

3. Identify routine management strategies for sand, shorelines, beaches, bluffs, ravines and ecological habitats at these lakefront properties

4. Outline expected agency approvals and permitting for beach, bluff, and ravine management.

This plan was developed with input from the Park District of Highland Park, regional experts, and regulatory agency coordination.

1.0 INTRODUCTION

OVERVIEW

The Park District of Highland Park (PDHP) manages four lakefront properties along the Lake Michigan shoreline. The lakefront properties are, from north to south, Moraine Beach, Park Avenue Boating Facility, Millard Beach, and Rosewood Beach, and total approximately 5,100 linear feet of shoreline (Fig 1.1). All the beaches are backed by an inland bluff of varying height.

Access, use, and programming at the beaches varies. Rosewood is the main public beach for swimming and recreation; it is the most developed and provides the most user amenities. Moraine is the least developed and functions partly as the Park District's dog beach. All of the beaches are impacted by the natural dynamics of Lake Michigan as well as forecasted issues associated with climate change and increasing use by residents and visitors to the Park District's beaches.

The high lake levels of 2019 & 2020 coupled with severe seasonal storms have resulted in beach inundation and erosion at some beaches, impacted public access, and raised bluff safety concerns. Also, impacts resulting from climate change threaten existing rare Illinois vegetative species. The following plan offers recommended actions for the protection, management, and enhancement of the beaches. It builds on the recommendations and actions that resulted from previous planning exercises.

Figure 1.1 Project Study Areas

NOT TO SCALE

PLAN PURPOSE

Climate change is expected to result in greater storm intensities and frequencies throughout the Great Lakes Region. These more intense storms will bring greater wave height and intensity along the lakeshore, more intense stormwater runoff resulting in erosion in ravines and along bluffs adjacent to the shore, a general average temperature rise resulting in less lake ice, and greater fluctuation in lake levels.

This plan identifies practical, implementable, and management strategies for Moraine Beach, Park Avenue Boating Facility, Millard Beach, and Rosewood Beach to be resilient to climate change. The management strategies promote sustainable management efforts, identify anticipated permitting, define the operational and use strategies best suited for each lakefront property, and recommend capital improvements for each property.

The previous studies most closely related to this plan include:

2005 Ecological Restoration Plan The 2005 ERP documented the quality and diversity of natural areas and habitats within the properties owned and managed by the Park District of Highland Park. The ERP proposed restoration goals and schedules for managing and improving desirable natural areas and habitats. This plan was updated in 2011 and 2017.

2007 Lakefront Master Plan This plan proposed short- and long-term recommendations for the improvement of the lakefront. Recommendations were beach-specific focusing on improving public access, managing revenue, improving connectivity, and enhancing programming.

2019 Lakefront Master Plan Update (2019 LMP) Beginning in 2017 the Park District began preparing an update to the 2007 Lakefront Master Plan. The update revises recommendations and proposed outcomes to reflect the desires, uses, and needs of the community of Highland Park.

2019 Rosewood Beach Nourishment In 2014, SmithGroup was hired by the Park District of Highland Park to undertake a monitoring study of the newly constructed Rosewood Beach and the adjacent shoreline. Over the years, recession of the beaches within the coves of Rosewood Beach was observed as Lake Michigan water levels rose to historic high levels. Reviewing strategies for mitigating erosion, a campaign of sand nourishment was undertaken in 2019 (swimming and interpretive coves) and again in 2020 (recreation and interpretive coves). Additional rock and geotextile fabric was placed along the southernmost breakwater to limit sand loss through the rock structures. PDHP hired SmithGroup to engineer and design buried riprap revetments along the back of the coves to mitigate damage to infrastructure and the parking lot should high water levels return and the trapped sands be eroded from within the coves. These revetments may be installed in the future should they be required.

Park Avenue Boat Launch The Park District of Highland Park was monitoring the condition of the boat launch barge for a number of years before the top collapsed at the beginning of 2018. PDHP hired SmithGroup to inspect the barge and provide repair or replacement strategies. Proposed strategies were ranked based on effectiveness, ease of construction, ease of permitting, cost, and aesthetics. Though broken, the remaining barge provided benefit to the shoreline shape and some level of protection to the launch, which was greatly hindered by the high water levels of 2019 & 2020. As such, immediate action was not deemed necessary. The strategies for repair/replacement of the barge are, as of the publication of this document, still being reviewed.

The PDHP lakefront properties are an important asset to the community. The beaches provide open, unbroken views of the lake and are backed by vegetated bluffs; visually separating the beaches from the City of Highland Park. This creates a refuge from the bustle of development.

The beaches, bluffs, ravines, and other lakefront properites are not without their challenges. The historic high-water levels

Figure 1.2 Rosewood Beach, Highland Park, IL

Figure 1.3 Moraine Park Beach, Highland Park, IL

of 2019 & 2020 inundated and eroded the flat beaches, and threatened bluffs and infrastructure. At some lakefront properties, there is evidence of bluff toe damage. In Millard Beach, a portion of the bluff has failed and threatens the stability of the entire bluff face and park trails located at the top of the bluff.

In addition, much of the beach face habitat was lost during this time. Due to the limitation of the dry recreational beach, users occupied and trampled areas that would otherwise have been left undisturbed and reserved for vegetation and nesting habitat.

An approved beach management plan provides a supported systematic approach to lakefront stewardship. With a beach management plan, the PDHP can be better prepared for the future and make informed decisions when budgeting for improvements at each of the beaches.

PLAN GOALS AND OBJECTIVES

Through this document, the PDHP looks to make implementable and sustainable improvements to the district's lakefront properties.

Objectives include:

- Identify implementable guidelines and recommendations.
- Provide management strategies that protect the character and reflect the programming of each lakefront property.
- Work in concert with current PDHP planning efforts.
- Identify shoreline stabilization issues and propose recommended solutions
- Protect important habitat as it relates to active and passive recreational uses.
- Identify the role of regulatory and permitting needs for planned actions.

SUMMARY OF THE PLAN PROCESS

This plan was developed through on-going coordination with various representatives and departments of the PDHP. The five-step planning process used to develop this plan was conducted between the spring of 2020 and the spring of 2021. An outline of the plan process was as follows:

1. Inventory and evaluate existing lakefront, bluff, and ravine conditions.
2. Review relevant requirements from beach management and permitting authorities.
3. Develop draft management recommendations and strategies.
4. Refine management recommendations and strategies based on interviews with experts.
5. Virtual public comment period.

The plan was refined to reflect public input and presented to the Park Board of Commissioners for approval in March 2021.

2.0 SITE ANALYSIS

The following provides a site analysis for each of the PDHP managed lakefront properties as well as the effect of Lake Michigan itself. For reference, the primary units used within this document are imperial and all vertical elevations, unless otherwise specified, are provided in NAVD88 datum. The conversion of chart datum for this location is 577.5 IGLD85 = 577.6 NAVD88.

Lake County, IL GIS topographic data is used for this study. This data includes 1 ft topographic contours collected in 2007 and 2017. The max water levels in each of those years was 577.8 and 580.8, respectively. Supplemental information, if used, is noted in the analysis of each beach.

Figure 2.1 Rosewood Beach, Highland Park, IL

SITE LAKE DYNAMICS

Sediment Transport

Variation of Great Lakes water levels directly affects the shape of the shoreline, known as shoreline morphology. The movement of the sand along the shoreline can be described as cross-shore transport (perpendicular to the shoreline) and longshore transport (parallel to the shoreline). Longshore and cross-shore transport occur simultaneously.

Cross-Shore Transport: Sandy shorelines respond to changing water levels. Higher water levels inundate the nearshore leaving less dry beach areas. In addition, larger waves during high water levels pull sand and other soft sediments offshore where heavier sands form sand bars (Fig. 3.2). During low water levels, waves will break further offshore and drive the sandbars back up onto the shoreline. Onshore winds running over dry beaches will blow the exposed sands further up onto the shoreline, contributing to the dry beach and dune system. If left undisturbed and dry, vegetation will grow in these areas from the inland and backshore area.

Longshore Transport: A longshore current forms within the wave breaker zone and along the shoreline which carries sediment in a longshore drift (Fig. 3.3). Sand and other soft sediments can be carried great distances during a storm event. Longshore transport results from oblique wave attack. As with winds, waves along a shoreline do not always arrive from the same direction and therefore sediment travels along the shoreline in both directions. If there exists a dominant wave direction, a net transport will result.

In the case of the shoreline of Highland Park, waves more predominately arrive from the north which results in sediment transport to the south. While there are storm and wave events that come from the south, which result in transport to the north, they are not frequent enough to balance the transport, and therefore the net transport results in sediments moving along the shoreline to the south.

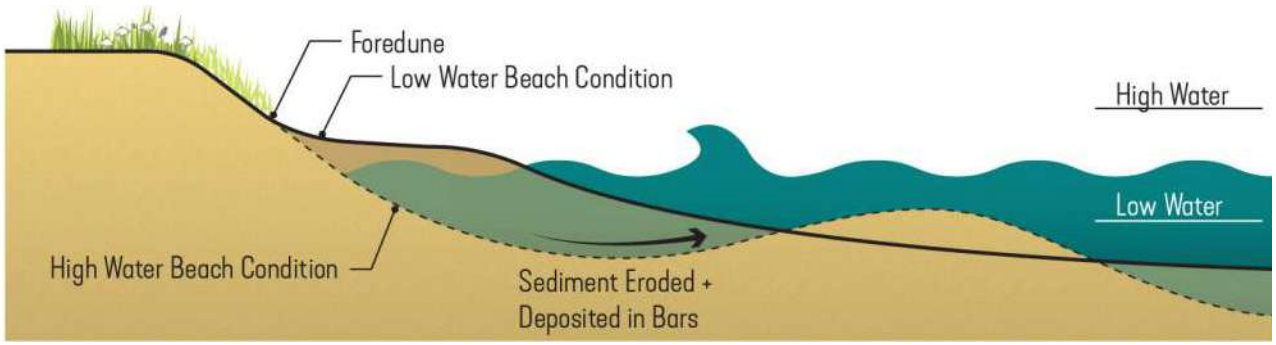


Figure 2.2 Cross-Shore Transport

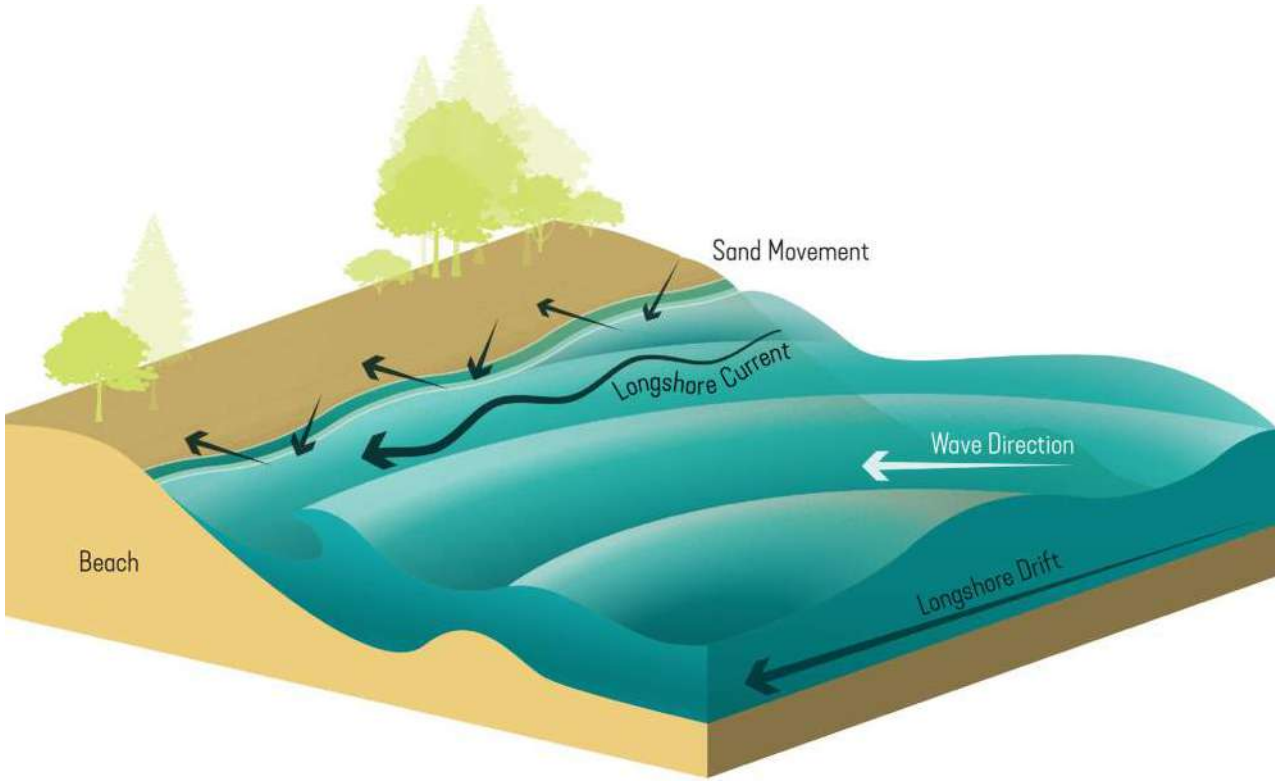


Figure 2.3 Longshore Transport

It should be recognized that given a wave environment offshore, the angle of the shoreline to the dominant wave direction directly influences the net transport potential. In the case of Highland Park, as more waves arrive from the north, a shoreline angled more perpendicularly with those incoming waves will result in less longshore transport. Therefore, with all other influences being equal, shorelines are more stable when perpendicular to the north.

Bluff Stability: Lake bluff and ravine slopes are by nature fragile and prone to erosion and slippage. Steep slope movement and failures can be exacerbated by above-average rainfall and high lake levels.

Over-saturation of soil is the major factor in slope disturbance. Wave action at the toe of the lake bluff, or stream energy at the bottom of ravines, causes erosion of the base which can lead to future slumping of the slope above (Fig. 2.4).

Lake bluff and ravines are sensitive to surface runoff which washes out soil and can create paths for future erosion.

Groundwater moving through sand seams can build up behind the top layer of clay and weaken the bluff internally by adding weight and reducing the frictional resistance between soil particles. This can lead to slippage of of areas well above the toe of the slope (Fig. 2.5).

Water Levels

Water levels presented in the Federal Emergency Management Agency's (FEMA) Flood Insurance Study, Lake County, Illinois 2020 (preliminary) were used for the analysis presented in this study because they represent the most current flood information for the four lakefront properties. An independent analysis performed by SmithGroup, Inc. found still water elevations within 0.1ft of the FEMA study. The Highland Park beaches evaluated in this study span four FEMA transects; water level information specific to each beach is given in the site analysis of each lakefront property described below.

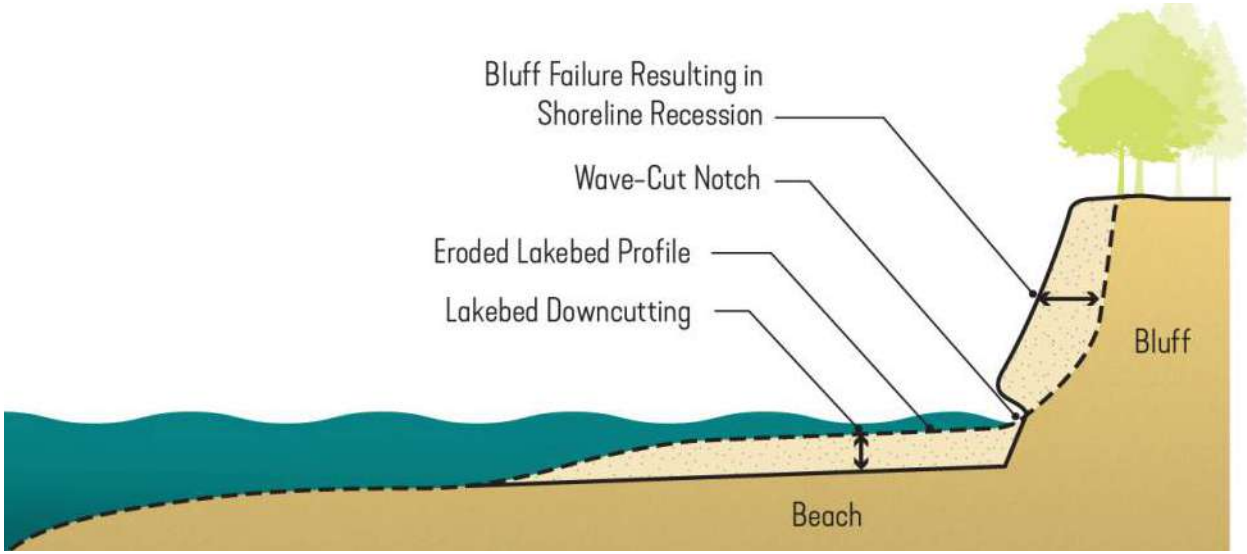


Figure 2.4 Bluff Stability

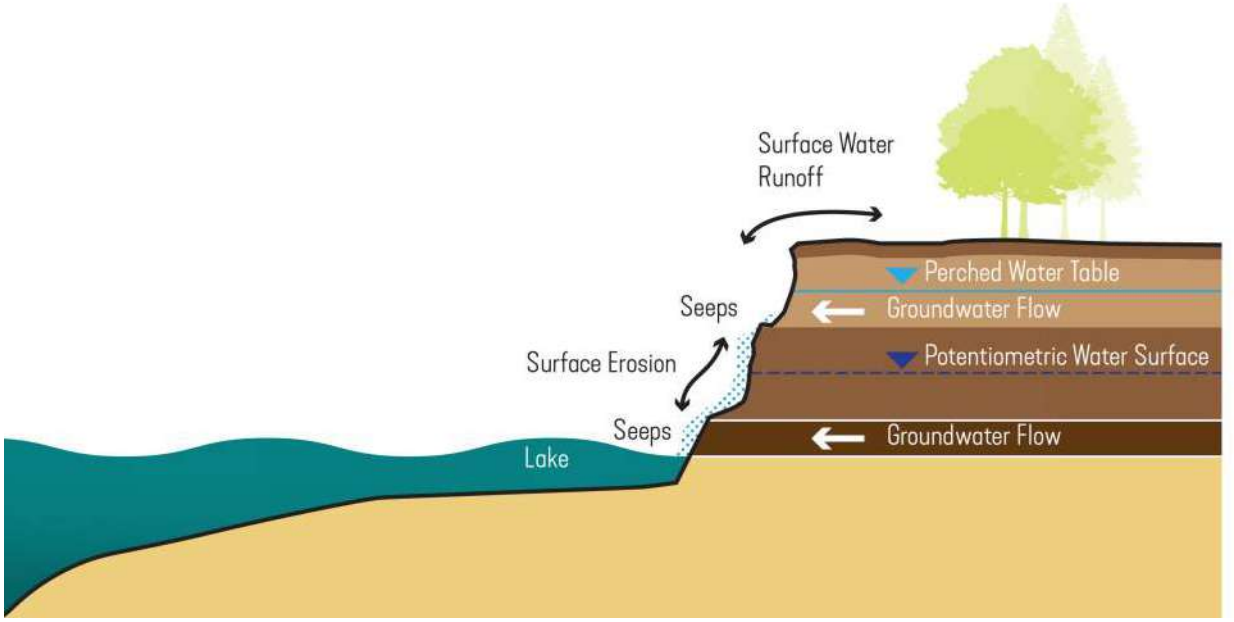


Figure 2.5 Stormwater & Groundwater Bluff Instability

Storm surge, which occurs when water builds up in one part of the lake due to a passing pressure system, is included in the FEMA study along with wave setup. The combined still water elevation, storm surge, and wave setup are called the "starting stillwater elevation." The FEMA starting stillwater elevation represents the water level along the shoreline without the additional influence of wave effects (wave amplitude, runup, and overtopping).

Water levels provided in this study were derived from FEMA's percent annual flood chance data. This data identifies the probability of flooding based on water surface levels, site elevation, and frequency of flooding within a given location. This study used the "starting stillwater elevation", the expected flood elevation absent the effect of waves, for the 10%, 4%, 2%, 1%, 0.2% annual chance of flooding for each of the lakefront properties based on the FEMA transects at each beach. The percent annual flooding represents the FEMA identified likely occurrence of flooding in a given location in any given year, based on a storm's probability. For example, the 10% annual chance represents the statistical probability that there is a 10% chance that a storm in any given year within a given location will result in flooding. The percent annual chance of flooding (10%, 4%, 2%, 1%, and 0.2%, respectively) were paired with FEMA's "1% annual chance total water elevation". The FEMA 1% annual chance total water elevation is a combination of the stillwater elevation at a given location plus wave action (amplitude, runup, overtopping) and represents the probability a flood will equal or exceed the expected flood elevation in any given year. It is worth noting that water level analyses are based on historical records. FEMA 2020 used water level station data from 1960 through 2009 and therefore does not include the high-water levels experienced between 2019-2020. In the design of protective structures, safety factors should always be applied to account for unknowns and water levels not yet experienced.

Small changes in bathymetry and the shoreline topography will influence wave runup and overtopping. FEMA studies look at long stretches of shoreline which are broken into sections. It is reasonable to assume that the FEMA analysis is not refined enough to account for all localized influences (ex. bathymetry and topography). Design along the shoreline should be based on a site-specific review of coastal processes with FEMA levels used as a planning guide.

Waves

As waves reach the shoreline, they break when the water depth becomes too shallow to support the wave. The region in which this happens is known as the breaker zone and breaking waves in this region are described as depth-limited waves. The FEMA analysis further describes depth-limited waves as having a height of 78% of the water depth and where 70% of the wave height is above the stillwater elevation. It should be recognized that high water levels in the Great Lakes have a greater influence on shoreline morphology than an intense offshore storm wave event. Though the waves might be large offshore, in shallow water they are broken due to depth limitation before they reach the shoreline. Higher water levels allow unbroken waves to travel further inshore before breaking. Sediment transport is greatest within the 'breaker zone' and therefore, shifting this zone further inland will result in greater shoreline change.

A review of offshore wave records from WIS Station 94027, which is approximately 3.4 miles offshore, shows that most of the waves, including storm waves, which impact the shoreline of Highland Park come from the north-northeast (Fig. 3.4). While waves tend to bend to be more perpendicular to the shoreline as they reach shallow water, this northerly angle indicates a general trend of sediment transport from north to south.

High-intensity storm events are more common in the fall and winter months of November through March; summer months of Lake Michigan remain generally calm. During winters with large shoreline ice build-up, the shoreline sediment remains protected. Conversely, shoreline erosion is more prevalent during warmer winters when there is little or no shoreline ice.

Winds

Winds, like waves, are most intense in the fall and winter months at the Highland Park beaches. However, unlike waves, winds along the shoreline come from a variety of directions; the most prevalent being from the south-southwest through the northwest (Fig 3.6). With fewer winds coming from offshore, the effect of winds carrying sands up onto the shore and creating dunes is also uncommon in this portion of the lake.

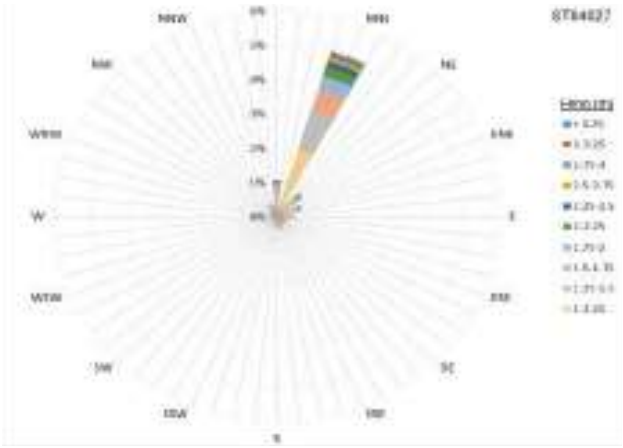


Figure 2.6 Wave Frequency and Directional Analysis

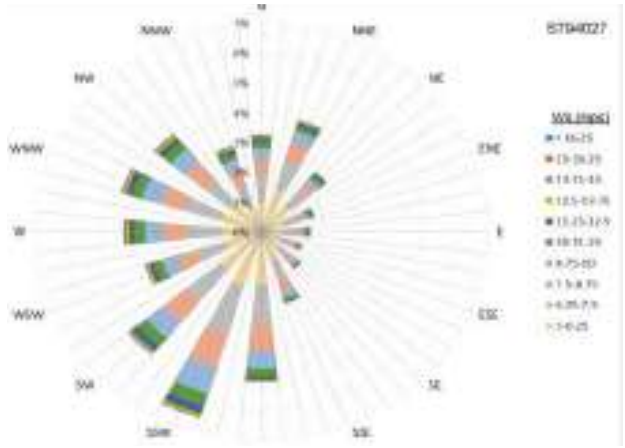


Figure 2.7 Wind Frequency and Directional Analysis

MORAINE BEACH

Moraine Beach is designated as the Park District's dog beach, offering passive recreational opportunities for beach visitors. The beach contains two sheetpile groins perpendicular to the shoreline intended to retain shoreline sediments. They are part of a series of sheetpile groins extending to the north and south. This is the least developed of the beaches manged by the Park District, primarily intended for dog owners.

Access

Visitors to Moraine Beach arrive first at Moraine Park, located at the top of the bluff and west of the beach. A 34-car visitor parking area is located on the west side of the park adjacent to Sheridan Ave. The park includes bike parking, picnic tables, and waste receptacles at the top of the bluff. Access to the shoreline in Moraine Park is via a pathway and stair directing beach-users from the park's scupture garden and restroom through the ravine to the beach. The path to the beach carries visitors down approximately 65 feet from the bluff top to the beach. Access for those with limited mobility is not possible.

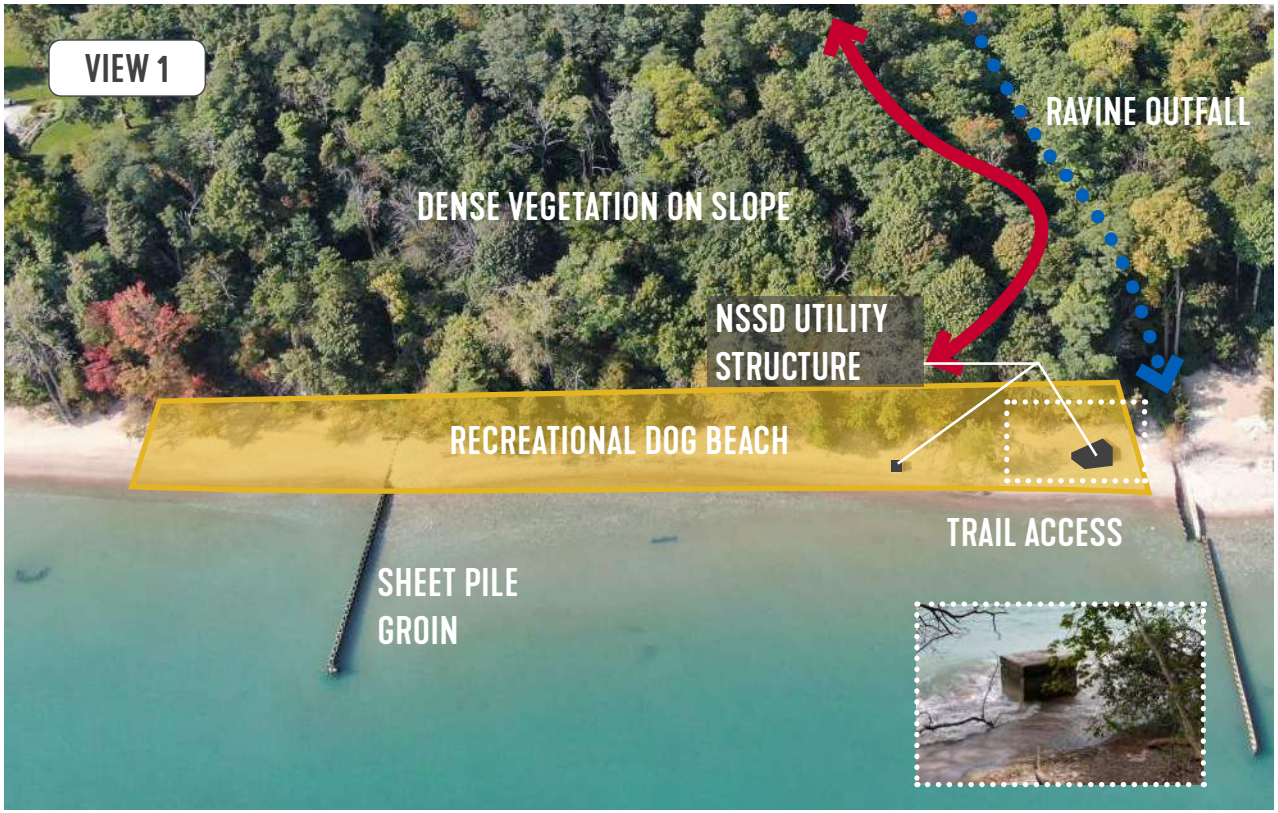


Figure 2.8 2020 Aerial Photo of Moraine Beach

The path leads visitors from the parking lot to a wooden set of stairs. At the base of the wooden stairs is a concrete bridge. The bridge connects on its east side with a flagstone path cut into the side slope of the ravine that parallels the ravine outfall stream, east to the lake. Slope subsidence on the flagstone path portion of the trail to the beach in 2019 has temporarily closed the beach to the public. Repairs are anticipated in 2022.

Because this is the only access route down to the beach, maintenance of the beach is limited to that which can be completed by equipment carried to the beach. More significant improvements to the site requiring that machinery be barged to the site. Water-accessed construction commands a premium over land-based construction methods and therefore is a consideration when making improvements to the site.

Existing Site Conditions

The beach is a gently sloping sand beach at approximately a 10H:1V slope, steepening to a 6H:1V slope before hitting the steeply rising vegetated bluff that backs the west edge of the beach. The bluff rises steeply from the beach at approximately a 2H:1V slope. The toe of the bluff, where the grade sharply steepens, is located along the 590 contour.

At the time of this study, the edge of vegetation appeared to be located along the 587 contour. Historical imagery shows the edge of vegetation shifts between the 586 and 590 contours which is likely a result of varying water levels and storm damage.

Because of the high lake water levels of 2019 - 2020, the dry portion of Moraine beach is narrow, only 10-12' in width, backed by a thick wall of vegetation at the base of the bluff. Scrub tree species from the bluff have invaded the beach and along much of the length of the beach. The roots of these trees were exposed during the 2020 site visit which is evidence of wave attack during storms (Fig 3.10). As a result, many trees along

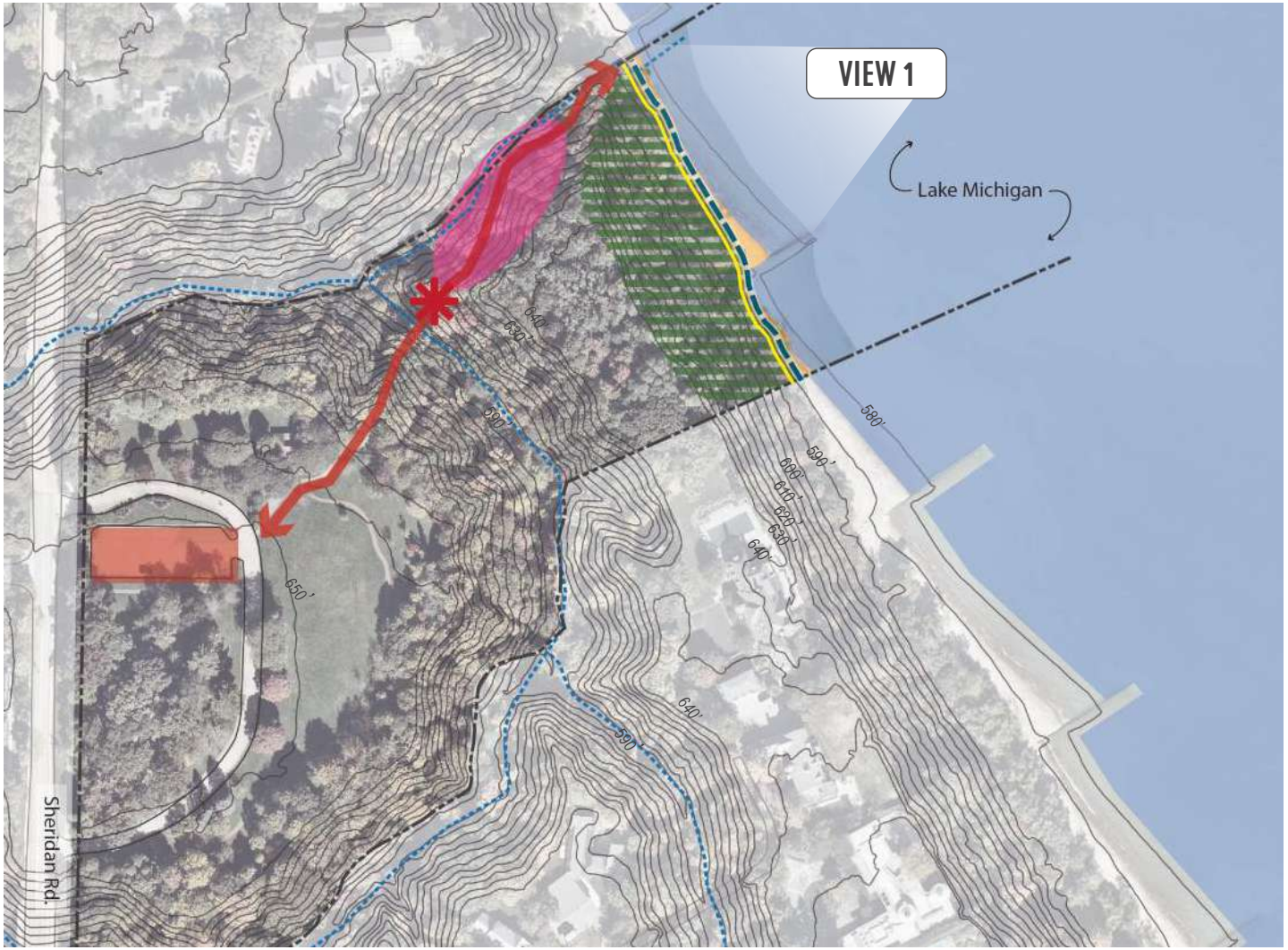


Figure 2.9 Existing Conditions at Moraine Beach

the sandy interface have fallen or are pitched toward the lake making walking on the beach during high water impossible without entering the water. Cutting of the bluff toe and removal of this soft sediment is an indication of future bluff instability issues even after lake levels recede.

The beach is composed mostly of medium to fine sand with a gravely base. Sand at the beach is captured at the shoreline by the groins extending into the lake (Fig 3.8). If the groins were to fail or someday be removed, the beach at this location would be destabilized and subject to much greater sediment transport and removal, and making the toe of the bluff even more exposed to wave attack.

The north end of the beach is characterized by a creek from the inland ravine. The ravine empties stormwater and runoff into Lake Michigan along the northside of the beach. Higher water levels result in a backup into the ravine and ponding of water.

Two concrete utility structures, part of the North Shore Sanitary District, emerge from the sand beach. High water levels have reached both structures.

During a single day visit to all the beaches, it was noted that during a typical day when winds and waves were coming from the northeast, which as noted is the most common direction at the site, Moraine Beach had the most aggressive wave action of all four beaches.

Water Quality

The Lake County Health Department regularly monitors the water quality at Moraine Beach. Water quality testing is conducted approximately 1 time per week. High bacteria levels will force beach closures for public health. Lake County Health Department notifies the Park District when levels are high to post signage at the beach for beach advisories and closures. Though not specifically noted as one of the tested beaches by the Illinois Department of Public Health, the primary sources of E. coli contamination at Lake Michigan beaches are gulls followed by unidentified sources, human/sewage sources, and terrestrial animals.

Figure 2.10 Root Exposure Caused by Wave Action Along the Bluff Toe

Moraine Beach Closures due to High Bacteria Levels
(ref. IDPH)

	No. of Closures		No. of Days Closed	
Year	Moraine	Avg.*	Moraine	Avg.*
2020	-	1	-	1
2019	-	2	-	3
2018	5	6	9	8
2017	1	5	5	7
2016	3	4	15	6
2015	5	5	13	8
2014	5	6	26	9
2013	1	4	4	6

*Averages are generated from other IDHP-tested public beaches in Lake County, Illinois.

Moraine Beach was closed by PDHP in 2019 and 2020 for safety reasons related to high water levels. When the beach is open, waste receptacles and dog waste bags are provided near the base of the trail, at the edge of the beach. Due to the inability to easily access the site with machinery, the beach is not regularly groomed.

Water Levels

FEMA 2020 flood elevations for Moraine Beach are as follows:

10% Annual Chance 582.6
4% Annual Chance 582.9
2% Annual Chance 583.0
1% Annual Chance 583.2
0.2% Annual Chance 583.3
1% Annual Chance Total Water Elevation 586.8

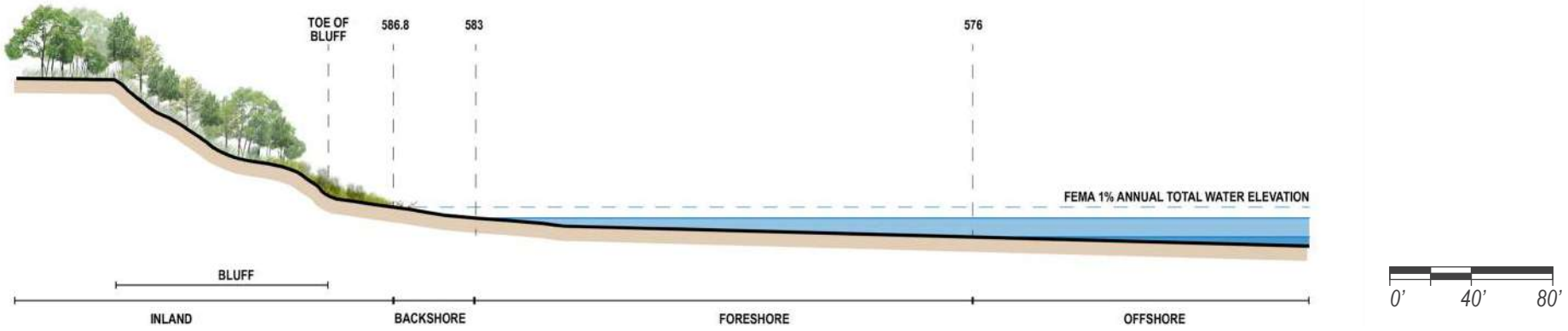


Figure 2.11 Cross Section of Moraine Beach

Sand Management / Erosion Control

The contour information shows little variation between the 2007 and 2017 surveys with no movement landward of the 589 contour (one foot below the toe of the bluff, 590) for the length of the beach. While there is some movement of sands on the beach, there is no indication of chronic erosion. Loss of dry beach can primarily be associated with inundation resulting from higher than normal lake levels. A wider dry beach can be expected to reappear when lake water levels recede.

However, as referenced, the toe of the bluff is experiencing a direct wave attack due to high water levels. This has led to erosion of the toe and around the tree roots which may lead to overall bluff instability. This will not self-repair once lake levels recede.

Ecological Conditions

The lakefront property at the top of the bluff is comprised of iconic park landscaping: canopy trees and underlying mown turf. Beginning at the top of the bluff and the initial descent into the ravine, a mixed woodland habitat develops. Canopy cover in the woodland is dense. Tree species observed included a mix of oak, basswood, maple, ash, boxelder, and locust. The largest and oldest trees observed were oaks which would not have grown in the deep shade currently found on-site, suggesting the historical structure of the ravine was more open; probably resembling an oak opening to oak savanna condition.

The ground layer vegetation on the lakeside bluff is sparse due to the depth of shade in wooded areas. Desirable perennial native species were observed on bluff slopes. However, ground layer vegetation on the bluffs also contained undesirable invasive species.

Vegetation along the beach interface is overgrown. Younger scrub trees (ash and boxelder) grow along a grade bench behind the beach and at the toe of the bluff. Many of their roots have become exposed due to wave action, these trees may struggle to survive or die over the coming year.

The outfall stream runs along the bottom of the ravine and discharges into the lake at the north end of Moraine Beach. Because the outfall hits the lake at the same grade as the surface of the lake at high water levels, much of the lower portion of the outfall is a backwater eddy of the lake. Fish spawning in the ravine outfall is hindered when water levels are high and the outfall becomes backedup due to sand.

PARK AVENUE BOATING FACILITY

The facility at Park Avenue Boating Facility is split into two distinct locations: the passive recreational beach to the north of the City of Highland Park's Water Plant ('North Beach', Fig 3.12) and the North Shore Yacht Club (NSYC) and boating beach to the south ('South Beach', Fig 3.13). Both beaches at this lakefront property are intended for passive recreation and fishing with the addition of motorized and non-motorized boats launching at the property's south end. Neither beach promotes swimming. The beaches at Park Avenue provide picnic tables, benches, and trash receptacles. The bluff sits far back from the North Beach. This flat area between the top of beach and the bluff is utilized for parking.

The sheetpile foundation of the City of Highland Park's Water Plant extends out into Lake Michigan. Due to the littoral transport from the north, sediments built up over time and created the passive recreation beach. Of the four beaches, the North Beach at Park Avenue is angled the most toward the northeast and is therefore the most stable.

The sandy shoreline of the South Beach is held in place by the extension of a shore-parallel groin which forms the protective barrier to a concrete ramp boat launch. This groin is constructed from a sunken barge that suffered severe damage to the lakeside face and surface in 2018. Though damaged, the barge still provides a level of protection and its presence directly influences the sandy shoreline beach shape within its shadow.

Though outside the property"s boundaries, the shoreline to the north and south of the park is lined with shore perpendicular sheetpile groins which help retain sediment along the shoreline and slow longshore transport.

Access

Access to the beach is from the west on Park Ave, traveling is one-way to the beach. Egress is by way of Egandale Rd to the north.

Figure 2.12 The passive recreational beach at the Park Av. Park beach on the property's north end, 2020.

Walkers, runners, and bikers use Park Ave and Egandale Rd as wide multi-use trails. There are no bicycle lanes along Park Ave or Egandale Rd forcing bicycles and cars to share the road. Both roads do include a narrow sidewalk. There are also no bike racks at the beach. As a result, bikes are locked to trees, light poles, etc.

Pedestrian circulation on the beach is across native, unconsolidated beach material (sand and gravel). This material does not provide universal access without stabilization or a mat.

Existing Site Conditions

North Beach

The North Beach runs north from the arrival point at Park Ave. It is comfortably wide and predominantly sandy with some gravel areas. The beach is speckled with some larger blocks of concrete which create make-shift seating.

The North Beach is a gently sloping sand beach of approximately 10H:1V slope. This slope flattens along the natural, open shoreline to the north and south of the parking lot whereas the parking lot is predominately above the 590 contour, forming a steep sand barrier of approximately 4H:1V slope along the parking lot lake face. The toe of bluff to the north of the parking lot, where the grade sharply steepens, is

Figure 2.13 The North Shore Yacht Club and boat launches at the property's south end, 2020.

along the 590 contour. The block of land between the parking lot and the water plant has a high elevation of 589.

The edge of vegetation appears to be currently along the 587/588 contour. Historical imagery shows the edge of vegetation shifts between the 585 and 590 contours which is likely a result of varying water levels and the unnatural embayment of sands within this corner.

Vegetation on the beach is limited. However, smaller scrub trees (ash and boxelder), as well as some scrub shrubs, are within the backshore. The depth of the beach could provide for a more deliberate desirable native planting regime which would enhance habitat. The establishment of native dune grasses and flowering perennials on the west edge of the beach beyond the primary visitor spaces is feasible.

As the most stable of the four Park District beaches, North Beach at Park Avenue has remained wide and open despite higher water levels in 2019 & 2020. No major indicators of erosion or wave attack on the toe of the bluff were observed at the time of this study suggesting this beach is at less risk due to high water levels than the other beaches.

South Beach

South of the City of Highland Park Water Plant is the South Beach. This beach is primarily dedicated to launching paddle craft and sailboats associated with the North Shore Yacht Club. Adjacent is a concrete boat ramp for trailered boats. The City of Highland Park Water Plant extends out into Lake Michigan beyond the native shoreline. Due to the predominate north to south littoral transport, the downdrift side of the promontory is starved of sand. The extension of the barge allows for some portion of sand to remain. Without the barge or some other hard groin feature, the beach would not remain. The lack of a beach before the installation of the barge can be seen in historical images from 1974 when the water level was approximately 581.

The barge, which acts as a groin, protects a concrete boat ramp that would be unusable if the barge were removed. Sand deposits on the ramp require periodic removal. While the maintenance frequency of removal could be reduced if the groin were lengthened, sediment deposition in this area should be expected to continue due to natural littoral drift along the shoreline.

During high water levels, the ramp becomes inundated making launching difficult. The top of the Park Avenue boat ramp is at an elevation of ~584.5. The parking area adjacent to the launch is of similar elevation and is subjected to wave runup and overtopping during storm events.

The North Shore Yacht Club building is tucked against the bluff, south of the water plant. Historic imagery shows this area to be sandy and dry in still water conditions. Though it is provided some protection by a fronting beach, it sits at an elevation of 590 and is not without risk of flooding from high water elevation with surge and runup.

The slope of the beach directly south of the water plant is flatter, approximately 10H:1V slope, making this area good for recreation and boat storage. However, toward the southern end of the property, the beach narrows and steepens to 6H:1V – 8H:1V slope. The elevated parking pad to the south of the Yacht Club building extends into the foreshore and therefore influences the shoreline around it. Higher water levels impact the southeast corner and have resulted in damage.

The edge of vegetation on the southern side of the property appears to be currently along the 587/588 contour.

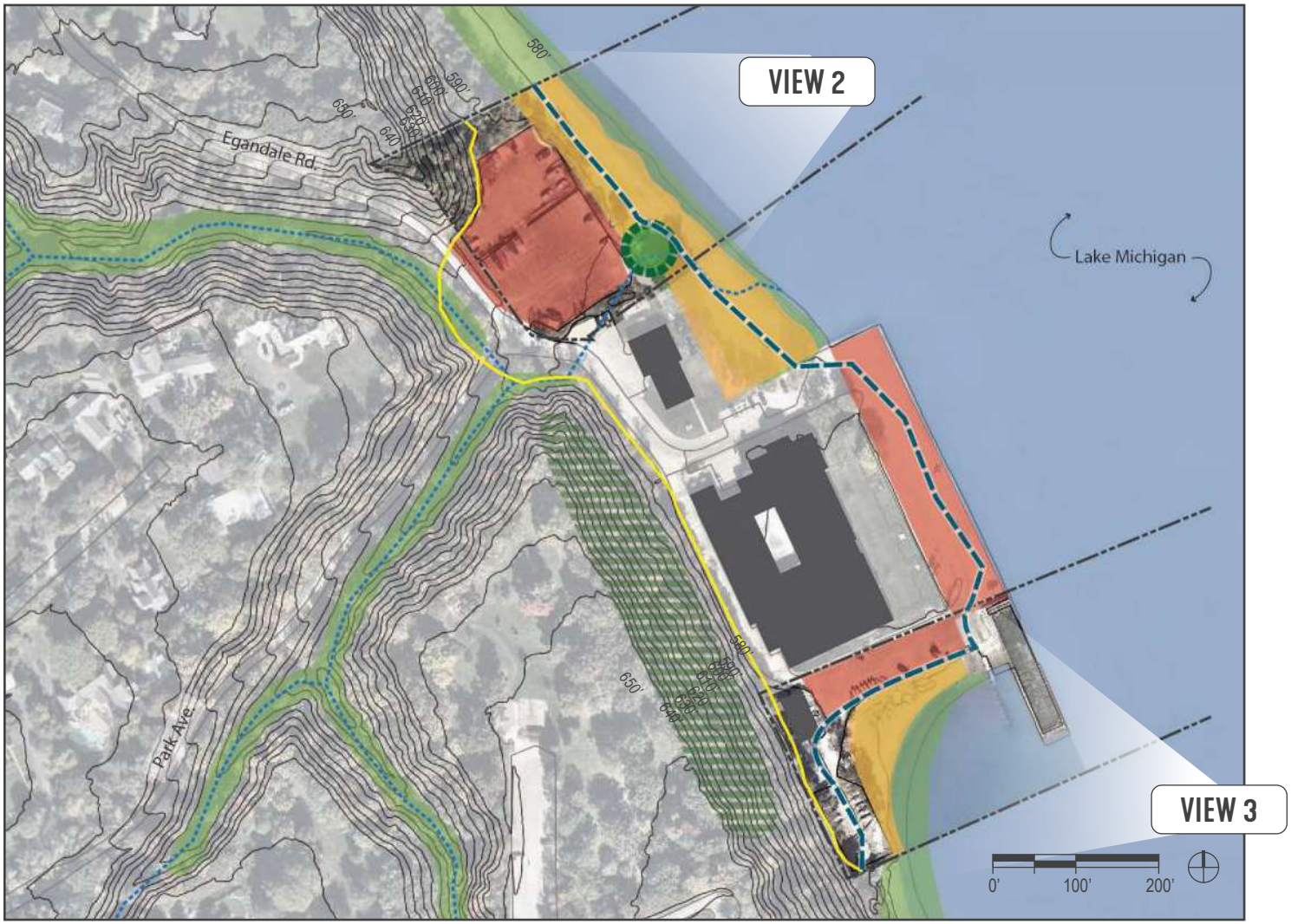


Figure 2.14 Existing Conditions at Park Avenue Boating Facility

Water Quality

The ravine outfall drains stormwater from upland areas and enters Lake Michigan through a concrete culvert at the south end of the parking on the North Beach. Also, the parking lot in North Beach is one of the locations used by the City for snow storage during the winter. Road snow removal contains salts and debris; these contaminants leach into the beach sand and pollute Lake Michigan.

The Lake County Health Department regularly monitors the water quality at Park Avenue Boating Facility. Testing is conducted approximately 4 days per week at the south beach boating area. High bacteria levels will force beach closures for public health. Signage is posted at the beach by PDHP staff to indicate beach advisories and closures. The primary sources of E. coli contamination at Lake Michigan beaches are gulls followed by unidentified sources, human/sewage sources, and terrestrial animals according to the Lake County Health Department studies of 2002 and 2003.

Park Avenue Boating Beaches Closures due to High Bacteria Levels (ref. IDPH)

	No. of Closures		No. of Days Closed	
Year	Park Ave	Avg.*	Park Ave	Avg.*
2020	0	1	-	1
2019	5	2	6	3
2018	6	6	6	8
2017	4	5	16	7
2016	1	4	4	6
2015	2	5	2	8
2014	5	6	13	9
2013	4	4	13	6

*Averages are generated from other IDHP-tested public beaches in Lake County, Illinois.

Water Levels

FEMA 2020 flood elevations for Park Avenue Boating Facility are the following:

10% Annual Chance	582.6
4% Annual Chance	582.9
2% Annual Chance	583.0
1% Annual Chance	583.2
0.2% Annual Chance	583.3

1% Annual Chance Total Water Elevation 586.8 North Beach
1% Annual Chance Total Water Elevation 587.6 South Beach, Boating Facility

Figure 2.15 Remnant revetment stones on the north beach

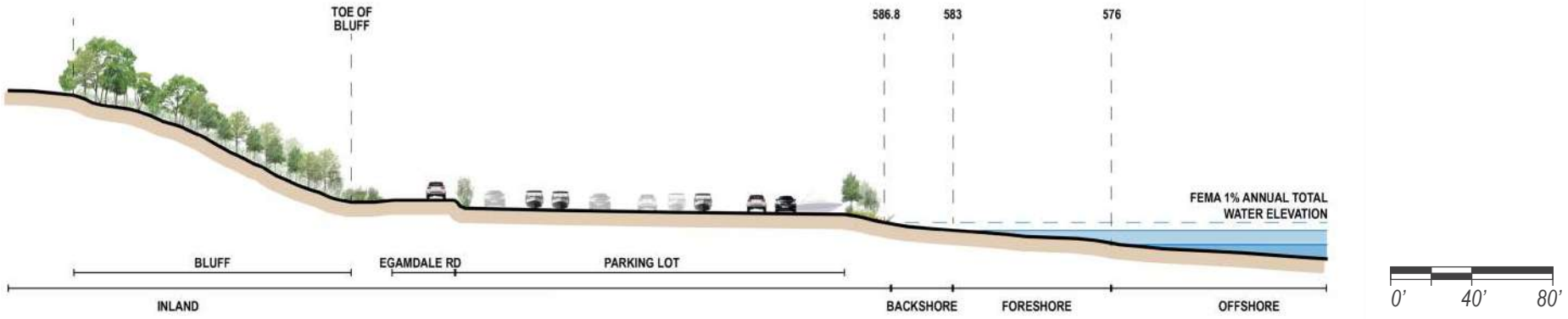


Figure 2.16 Cross Section of North Beach at Park Avenue Boating Facility

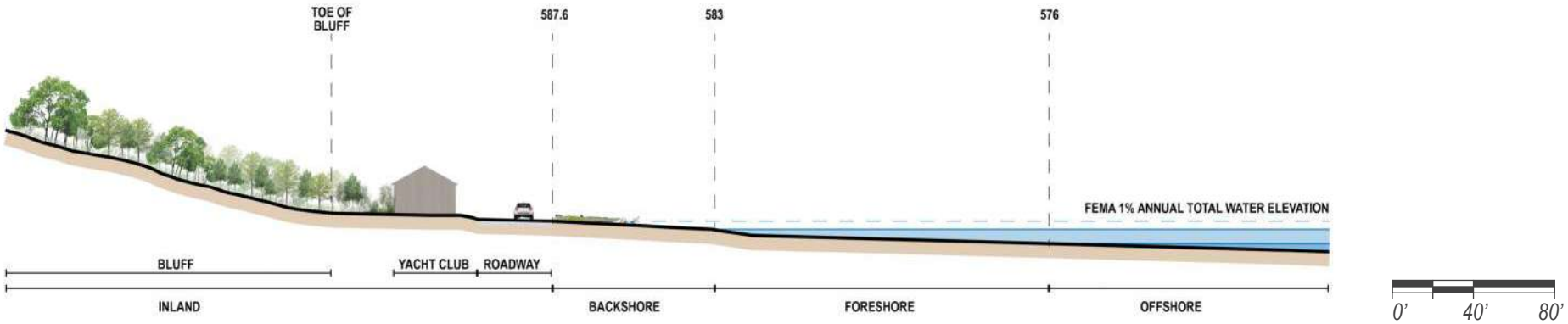


Figure 2.17 Cross Section of South Beach at Park Ave Boating Facility

Variable water levels affected the two regions of the property differently. The northern beach, held by the protrusion of the City of Highland Park Water Plant, is angled more perpendicularly to the north and therefore experiences less longshore transport than its neighboring beaches. This makes the beach more stable throughout varying water levels.

As described, the south beach is held by the presence of the boat launch barge. Without the barge, this beach size would be significantly decreased if not completely eroded. Despite this protection, South Beach still experiences inundation and downcutting due to higher water levels. The shape of the beach follows a predictable 'spiral' beach shape which is determined based on water level and two hard points; in this case the barge and the end of the sheetpile groin to the south. As water level increases, the erosion and inundation will continue to extend further inshore. This effect will be stronger on the southern side of the property, and south of the NSYC parking pad. Without protection, the southern end of the parking pad will erode significantly, subjected to direct wave attack. While the beach area in front of the NSYC will become inundated, the still waterline at historic highest water level will not reach the building itself. However, wave runup in high water scenarios may still reach the foundation.

Sand Management/Erosion Control

The contour information shows little variation between the 2007 and 2017 surveys with no movement landward of the 580 contour within the North Beach. Therefore, runup and overtopping of the parking lot is due to water level alone and can only be mitigated by raising the parking lot or widening the dry beach through the construction of a coastal structure. Neither of these options are recommended; rather overtopped water should be dealt with through stormwater runoff pathways.

Comparison of the bathymetric surveys suggests steepening of has occurred at South Beach. While landward of the 585 contour remains much the same, the beach foreshore has steepened from a gentle 15H:1V slope to a steeper 10H:1V slope. This steepening is directly related to higher water level and larger wave energy pulling sands offshore. While some sand will reappear as water levels recede, accretion will take multiple seasons to refill the beach.

Again, it should be noted that the barge contributes greatly to the size of the beach in this area. Should the groin be removed or reduced in length, the stable shoreline will reduce in size accordingly.

Ecological Conditions

The Park District conducted canopy clearing on the bluff in 2008, however,the toe of the bluff on the west side of the beach and up the bluff face is over-vegetated. There are too many trees with too dense of a canopy cover. Many of the trees are draped and wrapped in wild grape and Virginia creeper, some poison ivy was also noted. Invasive non-native and native species were observed.

The dominant tree species observed near the base of bluff by the beach were willow, cottonwood, sumac, and ash. However, further up the bluff present in fewer numbers were larger, older oak. Suggesting that oak historically dominated the slopes of the bluff.

Although mostly native trees were found to dominate the bluff slopes, their frequency and number is higher than historically occupied the slope. Historically, the lake bluff was described as “prairie like,” primarily covered in grasses and forbes with white oaks growing at the top of the bluff. This can be seen in the photograph of the Water Works from 1894 (Fig. 3.18). Currently, the density of trees, and lack of vegetative ground cover, is likely contributing to slope instability.

Desirable dune vegetation is not expected to establish at this beach without separation from usable beach area. Where possible fencing or other forms of separation could limit the impact of beach users and enable native species to establish, particularly on upper beach reaches near the toe of the bluff.

Figure 2.18 Highland Park Waterworks, 1894

MILLARD BEACH

Millard Beach offers over 1,000 feet of shoreline for passive recreation. The beach contains eight sheetpile groins perpendicular to the shoreline intended to retain shoreline sediments. These groins are over 50+ years old and show signs of significant wear. The foundation of the former North Shore Water Reclamation District facility remains along the shoreline, adjacent to the park's parking lot, and aids in containment of longshore drift sediments. The parking lot at the beach is small and the outfall for the ravine effectively splits the site into two beaches, with the north more open and wider than the beach to the south.

Access

Access to the beach in Millard Beach is primarily via Ravine Drive with parking adjacent to the shoreline. Various walking trails wind through the property at the top of the bluff. The pathway down to the beach is steep and staired and is therefore not universally accessible. A 2020 bluff failure has resulted in a segment of the trail at the top of the bluff being eroded and fenced off for public safety.

The parking lot at the base of Ravine Drive is only large enough for nine vehicles. Because of the ravine stream, bluff, and adjacent private property, there is not room to expand this parking.

Ravine Drive is very steep making access to the beach by bike difficult. Furthermore, there is no sidewalk or bike path along Ravine Drive, pedestrians use the road to access the beach. This results in pedestrians pushing their bikes up the steep drive in the pathway of vehicles.

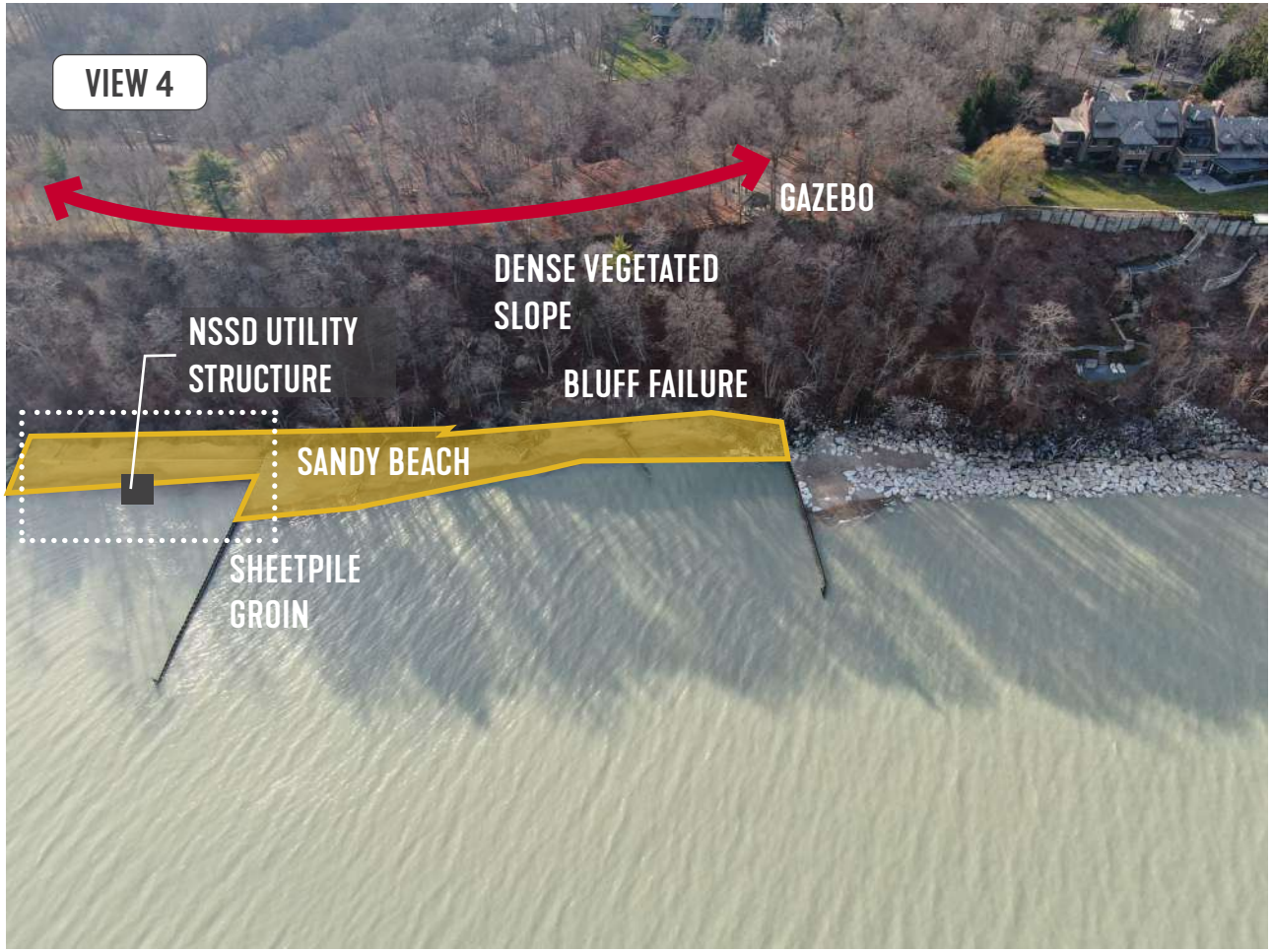


Figure 2.19 2020 Aerial Photo of Millard Beach, North

Existing Site Conditions

The top of the bluff on the north end of the park is between the 655 and 660 contours while the southern end of the park descends steeply to the parking lot located at an elevation of approximately 589. The toe of the bluff, where the grade sharply steepens, is located along the 587 contour resulting in a maximum bluff elevation of approximately 70 feet. The beach fronting Millard Beach varies in width and slope. As typical with shorelines that contain groins, the beach width is generally wider along the downdrift side of the groin and narrower on the updrift side but the average beach sand slope is a gentle 10H:1V slope.

The edge of vegetation varies between the 585 and 587 contours. Historical imagery shows the edge of vegetation has shifted in the past as water levels fluctuate.

The ravine which runs adjacent to Ravine Dr underwent restoration in 2011. Stormwater runs beneath the parking lot and daylights into a sheetpile channelized outfall which extends into Lake Michigan. This outfall can occasionally fill with migrating sediments but is regularly cleared during strong storm events. The outfall results in two distinct beaches: a northern beach and southern beach.

The northern beach is wider with fewer trees in the upper to middle beach portions furthest from the lake edge. The vegetation consists of low brush and dune grasses fronting larger trees located at the toe and on the slope of the bluff. (Fig 3.21 and 3.22). With the winnowing of the beach in the northern reaches of the property, this vegetation has been uprooted resulting in die-back and trees pulling away from the slope. This will further exacerbate bluff erosion.

The vegetation on the south side of the outfall includes more mature trees just beyond the shoreline but within the area of runup. Damage to the bark of the larger trees is visible from wave runup carrying abrasive cobble and sand. Less mature vegetation has been completely uprooted and is strewn on the beach as natural debris.

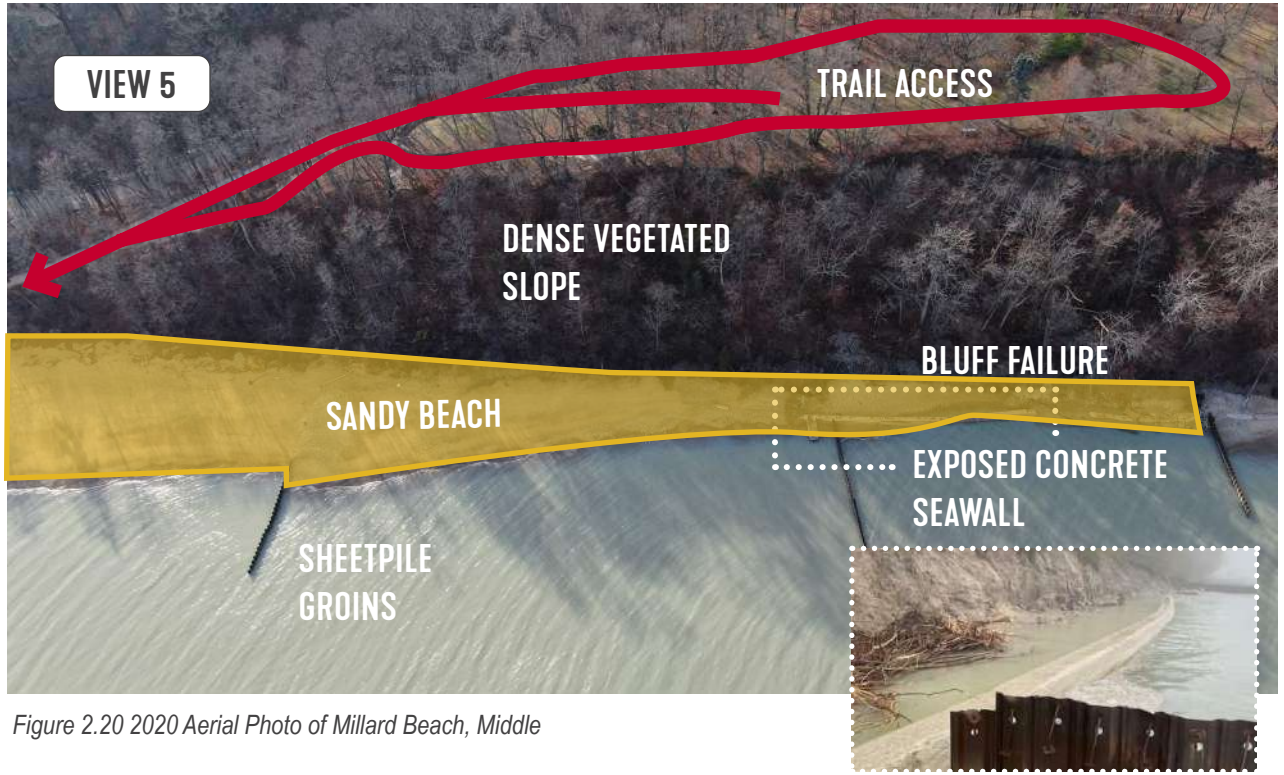


Figure 2.20 2020 Aerial Photo of Millard Beach, Middle

Figure 2.21 Millard Beach viewing North

Figure 2.22 Millard Beach Viewing South

A North Shore Water Reclemantion District sewer line runs parallel to the shoreline; offshore and through the groins. While the sewer channel walls are visible above the lakebed, the sewer line remains beneath the water surface and no damage has been reported by maintenance staff. However, it may be beneficial to place coarser sand fill inside the channel to limit future exposure. As the walls of the channel are made from sheetpile, human interaction is a safety concern.

Figure 2.23 2020 Aerial Photo of Millard Beach, South

The high-water levels of 2019 & 2020 resulted in segments of bluff failure between the first and fourth groin. The compromised toe exhibits an almost vertical face which is inherently unstable. Vegetation roots are fully exposed in some areas. While the primary cause of the bluff failure was wave attack at the toe and ground saturation, the dense tree canopy cover and open soft sediments contributed to the failure. Bluff face vegetation will continue to pull on the topsoil layer exposing the soft sediments below. The combination of weakening of vegetation roots as the plant withers and stormwater cutting into the soft soils will lead to a full bluff face collapse as the slope attempts to correct itself back to a stable position. This can happen immediately or may take years but without intervention, the current slope will break and slump.

It has been reported that seeps have been observed along the bluff face suggesting groundwater horizontal movement over a less permeable layer. As described in the section on bluff stability, these seeps weaken the bluff face and can lead to surface slumps.

The erosion of the beach between the second and fourth sheetpile groins fully uncovered a concrete retaining wall. It is unclear when this concrete wall was installed. It is believed this wall was installed as bluff toe protection. However, the crest elevation of this wall is low and insufficient to prevent surge and wave forces from eroding the bluff toe. The protection this feature provides is minimal.

Despite the high-water levels of 2020, wide areas of dry beach adjacent to the parking lot are available for passive recreation.

Millard Beach has signage informing users of features of the beach and park located at the parking lot. The bluff on the south side is privately owned and marked. Signs and fencing delineate the boundary.

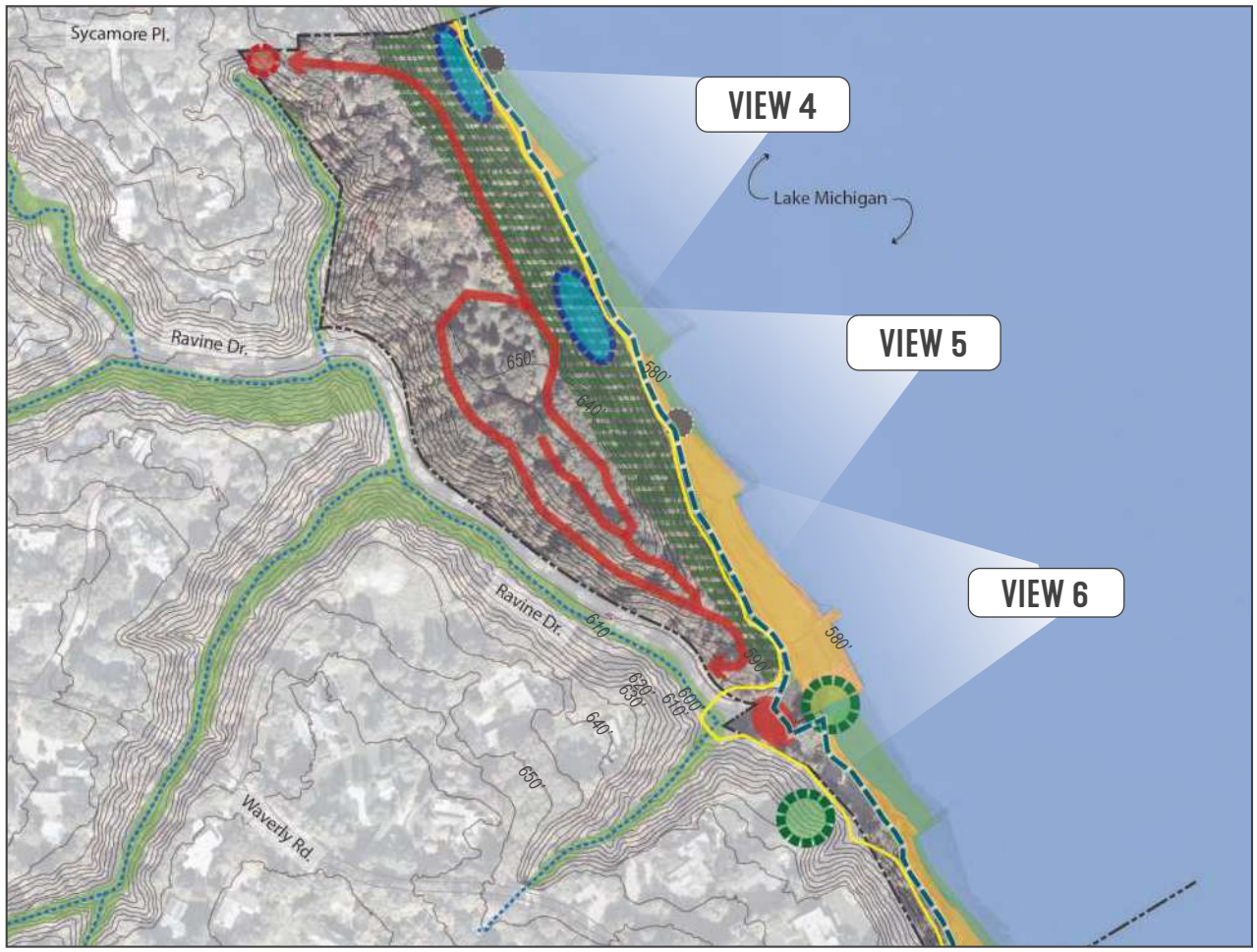
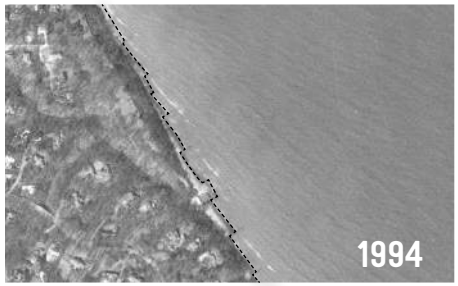


Figure 2.24 Existing Conditions at Millard Beach

1994 Shoreline



Water Quality

Water quality measurements are not collected at Millard Beach by the Lake County Health Department.

There is a residential stormwater discharge on the south beach which is outside of the property limits of Millard Beach but results in the discharge flowing over the beach and into Lake Michigan (Fig 3.26). While the discharge itself is outside the jurisdiction of the Park District, improvements to the area of the discharge runoff, such as rainwater gardens or hardened channelization, would limit the damage and likely contamination to the sandy beach in this area.

Water Levels

FEMA 2020 flood elevations for Millard Beach are the following:

10% Annual Chance	582.6
4% Annual Chance	582.9
2% Annual Chance	583.0
1% Annual Chance	583.2
0.2% Annual Chance	583.3
1% Annual Chance Total Water Elevation	587.9

Sand Management/Erosion Control

While contours within the foreshore exhibit adjustment to the higher water levels, a comparison of the surveys taken in 2007 and 2017 do not exhibit significant changes. Visually observable changes to the bluff and bluff toe suggest significant erosion and shoreline recession along the northside of the property post-2017. Sediment within the groin cells fluctuates and shifts north and south following weather events. This suggests that as water levels recede, the inundated portions of the beach will emerge.

The height of runup and influence of waves at the beach is estimated to be 587.9. Given the toe of bluff is located at roughly the 587 contour, this puts much of the bluff in jeopardy of toe erosion. Review of the 2017 survey shows areas where the toe of bluff starts at the 585 contour. Not coincidentally, these areas are where bluff toe failure can be seen in 2020 aerials.

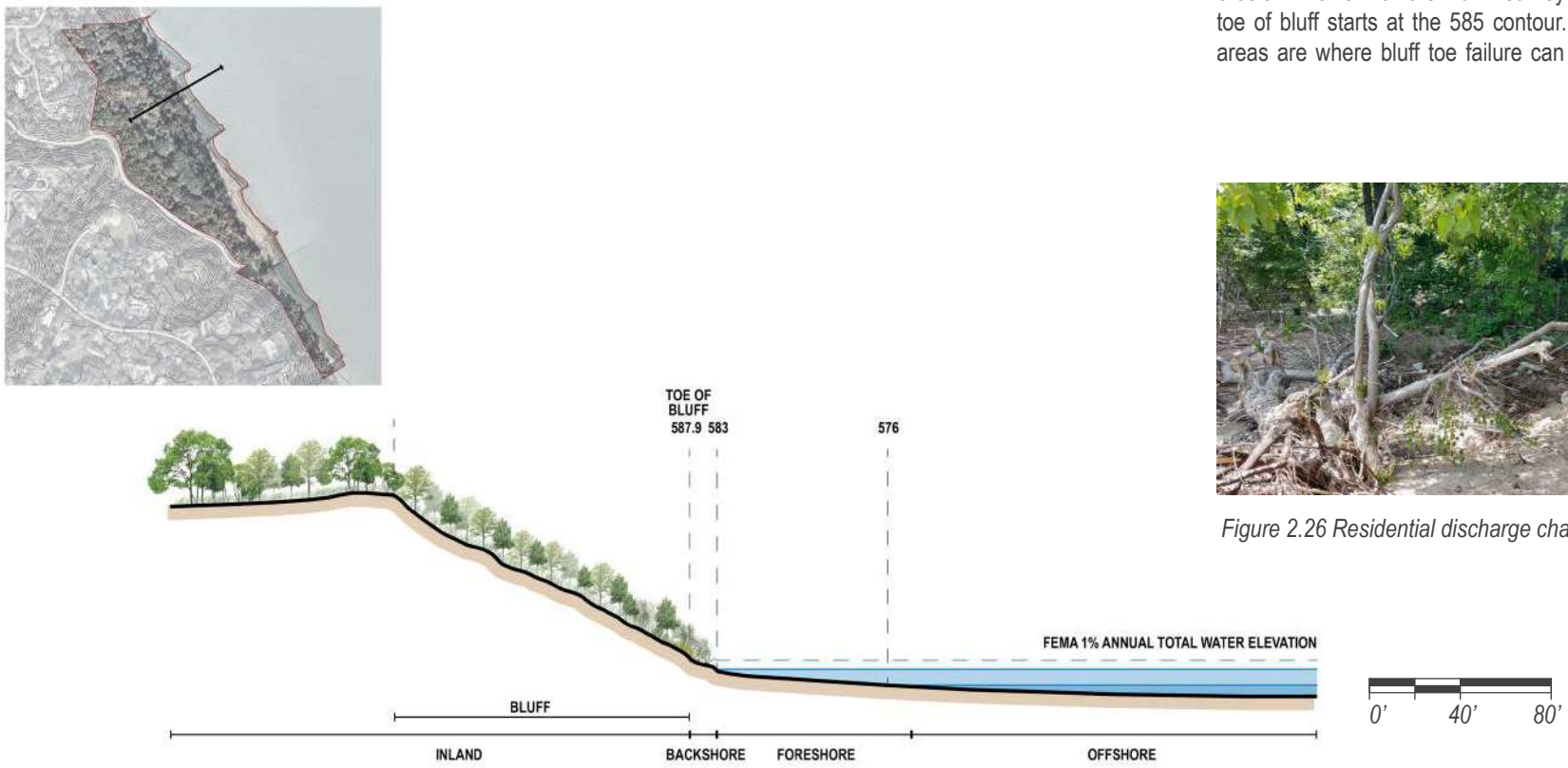


Figure 2.25 Cross Section of Millard Beach

Figure 2.26 Residential discharge channel across beach.

Ecological Conditions

Identified as a priority site in the Park District's Ecological Restoration Plan, with several high quality plant species identified, Millard Beach bluff was subject to canopy clearing by PDHP Parks staff in the winters of 2009 and 2010. Also, between 2015-17, the District received assistance through Sustain our Great Lakes habitat restoration funds to address invasive shrubs and vines including Oriental Bittersweet.

Despite these efforts, a dense canopy cover of ash, locust and other weedy tree species remains. Thinning the tree canopy, where possible, is needed to encourage stability and growth of groundcover that would stabilize the bluff.

Figure 2.27 Aerial Photo of Bluff Failure, Late Fall 2020.

Figure 2.28 Aerial Photo of Bluff Subsidence, Late Fall 2020.

ROSEWOOD BEACH

Rosewood Beach is the Park District's most prominent beach facility offering 1,300 feet of shoreline for swimming, nature programming, beach yoga, and a beachfront Interpretive Center which can be rented for private events. The current beach was reopened in 2015 following a major renovation. The renovation included extending riprap breakwaters 200 ft into the lake to create three coves; Interpretive, Swimming, & Recreation (N-S), each with their own identity and activity focus.

In addition to the Interpretive Center, Rosewood Beach includes a lifeguard house, covered picnicking areas, abundant seating, boardwalk, concessions, and a covered playground. Rosewood is the only public beach where swimming is allowed.

During the beach redevelopment, Rosewood Ravine outfall was improved and daylighted to empty into the Interpretive Cove.

Access

Rosewood Beach has two parking lots: one located next to the Interpretive Center at beach elevation accessed off Sheridan Road holding up to 40 cars and a drop off and another located at the top of the bluff at the south end of the beach off of Roger Williams Ave. Visitors parking in the south lot access the beach by stepped trail and staircase down the bluff to the beach's southern end. Bike parking is provided at both parking locations.

Unlike the other beaches managed by the Park District, Rosewood Beach includes a boardwalk system running the full length of the beach. This boardwalk provides ease of access to strollers and wheelchairs. For access onto the sandy beach, the Park District seasonally deploys a mobility mat. These systems make Rosewood Beach the only true universally accessible beach.

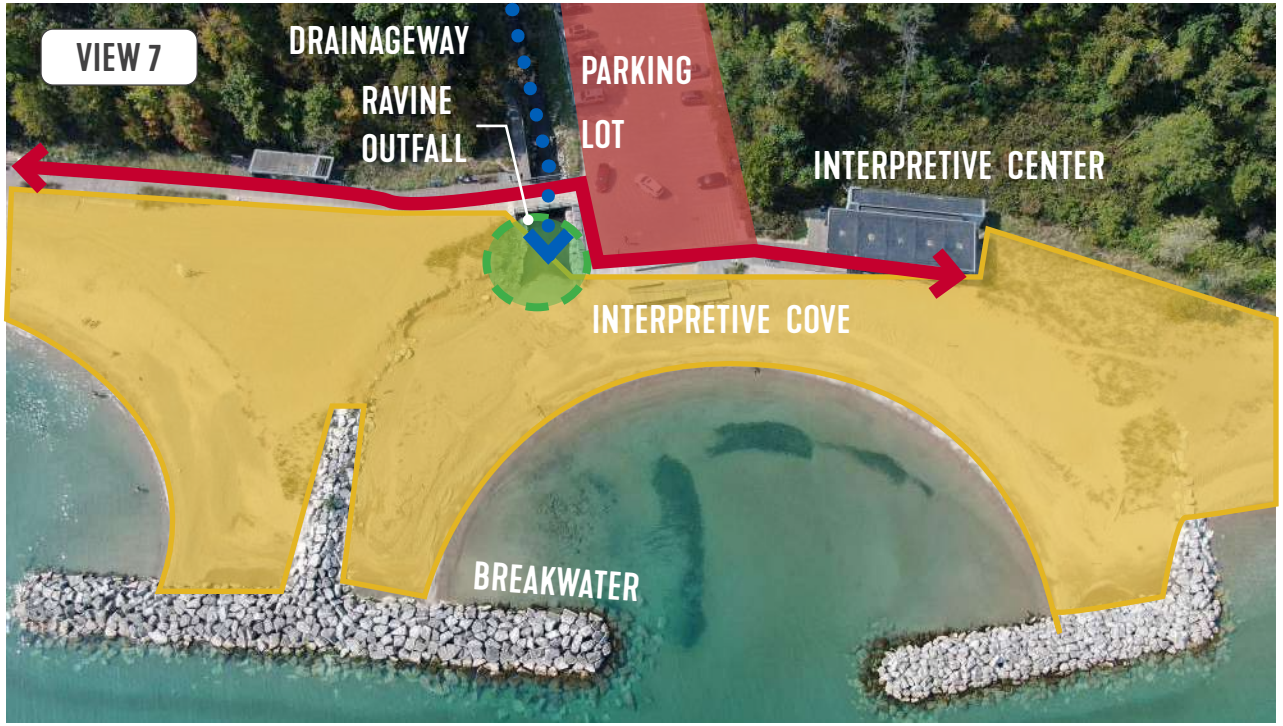


Figure 2.29 Rosewood Beach Interpretive Cove, 2020

Existing Site Condition

Like most of the lakefront property in Highland Park, the shoreline consists of 40-50' high bluffs fronted by a sandy shoreline. The man-made beaches were designed with gentle sloping beaches using fine grained sands desirable for recreational beaches. Changing water levels have modified the beach slope overtime.

The approximate toe of bluff for the full beach length is located along the 590 contour. It is located behind the gentle sloping top of beach and lakefront infrastructure. While beach slope within each of the coves fluctuates, the toe of bluff remains secure from direct wave impact given historical high water levels.

When the redesigned Rosewood Beach was opened in 2015, it featured shallow beach slopes. As water levels started to rise, storm intensity and wave penetration into the coves increased. This caused the beaches to steepen in response. A monitoring program of the shoreline found that sand was pulled offshore during strong storm events at high water and created low-lying sand bars outside the riprap breakwaters. The common oblique wave action along the shoreline of Highland Park results in much of this material being pushed south in the offshore littoral system. The erosion of the beaches reduced the dry recreation space, undermined back of beach structures, and eroded soft sediments beneath the new vegetation, destroying the dune grasses.

The three coves of Rosewood Beach are not designed the same. Each cove has its individual opening between the protective breakwaters and slightly varying directionality. Therefore, these three coves do not function the same. Furthermore, the distance from the breakwaters openings to back of beach infrastructure, such as the boardwalk and the Interpretive Center, also varies. As the beaches flatten due to high water level, infrastructure closer to the breakwater openings has been affected by surge, wave runup, and sand washout.

Responding to the significant flattening and removal of placed beach sands, the PDHP placed nourishment sands in all three

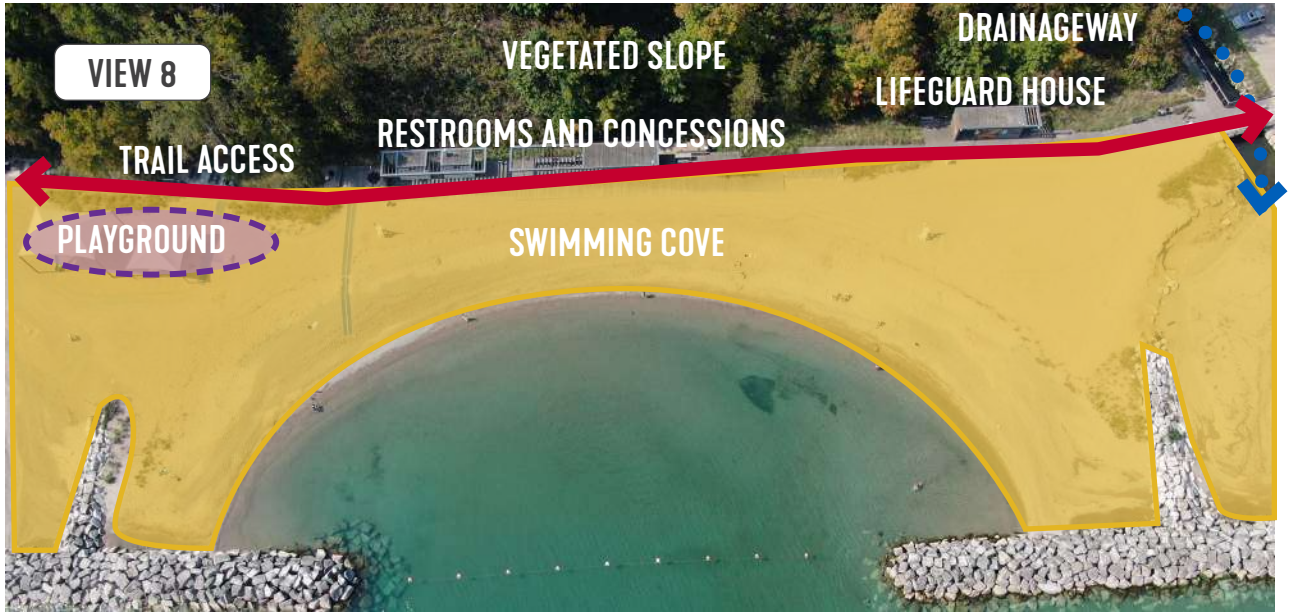


Figure 2.30 Rosewood Beach Swimming Cove, 2020

coves between fall 2019 and spring 2020. Two types of sand were placed at Rosewood Beach: 'Torpedo' sand, which is the same sand placed during the original construction, and 'Birdseye' sand, which is a coarser sand with larger grain sizes. The benefit of increasing the grain size is it limits beach slope flattening and materials being pulled offshore. Nourishment within Rosewood Beach consisted of 'Birdseye' sands placed in the Interpretive Cove, 'Birdseye' sands placed within the Recreation Cove, and a mixture of 'Birdseye' and 'Torpedo' sands placed within the Swimming Cove. Since placement, native and placed sands have mostly mixed. However, the heavier sands have built up on the south side of the Interpretive Cove where wave energy removes the softer sediments. This had led to the occasional blockage of the Rosewood Ravine outfall which has difficulty naturally clearing a pathway connection to Lake Michigan.

The PDHP frequently places signage at Rosewood Beach to inform the public as to improvements and provide general education about the park and habitat found within.

Water Quality

The Lake County Health Department regularly monitors the water quality at Rosewood Beach with testing being conducted approximately 4 days per week. High bacteria levels will force beach closures for the purpose of public health. Signage is posted at the park by PDHP staff to indicate beach advisories and closures. The primary sources of E. coli contamination at Rosewood Beach are gulls/avian species followed by unidentified sources, human/sewage sources, and terrestrial animals according to the Lake County Health Department studies of 2002 and 2003.

In addition to regular testing, Rosewood Beach has a SwimCast system installed to collect real-time measurements of air and water temperature, wind speed and direction, precipitation, relative humidity, wave height, lake stage, insolation (light energy), and other water quality parameters.

Rosewood Beach Closures due to High Bacteria Levels
(ref. IDPH)

	No. of Closures		No. of Days Closed	
Year	Rosewood	Avg.*	Rosewood	Avg.*
2020	3	1	3	1
2019	7	2	26	3
2018	2	6	4	8
2017	6	5	7	7
2016	8	4	9	6
2015	4	5	4	8
2014	-	6	-	9
2013	2	4	2	6

*Averages are generated from other IDHP-tested public beaches in Lake County, Illinois.

Rosewood beach was closed in 2014 for construction.

Water Levels

FEMA 2020 flood elevations for Rosewood Beach are the following (Fig 3.20):

10% Annual Chance	582.6
4% Annual Chance	582.9
2% Annual Chance	583.0
1% Annual Chance	583.2
0.2% Annual Chance	583.4
1% Annual Chance Total Water Elevation, Interpretive & Swimming Coves	586.7
1% Annual Chance Total Water Elevation, Recreation Cove	589.6

Sand Management/Erosion Control

As described above, the monitoring program revealed flattening of the beaches overtime. The extent of flattening and the erosion inshore can be directly related to water level, storm events, and sediment grain size. When Rosewood Beach was constructed, a large volume of sand was brought to the site from upland sources. This uniform material contained very little larger grained material and therefore a high percentage of the material was able to be lifted in the strong wave events and moved offshore. While some of this material will return to the beach as water levels recede, most is lost to downdrift littoral transport. New material from updrift sources will find their way into the coves at low water and deposit themselves on the beach as part of the natural beach dynamics. However, full natural re-nourishment of the coves will require a number of years of low water.

Beyond nourishment and increasing the grain size of the beach sand, structural changes to the breakwater would be required to maintain a wider beach during periods of high water.

Another pathway of sand loss is through the breakwaters themselves. While the construction of the beach's breakwaters include a solid impermeable core within their stems, the shore-parallel portions of the t-heads as well as the southern most breakwater do not. Water flows through these breakwaters with enough energy to lift and pull sand directly through the breakwater itself. The southern most breakwater was corrected for this by installing smaller, more impermeable stone along the inside of the breakwater in early 2020.

Ecological Conditions

Rosewood beach underwent significant bluff and beach restoration when the park improvement areas were developed. The bluff is dominated by appropriate native perennial vegetation and the canopy had been thinned to approximately a 30-35% cover. Only small populations of undesirable species remain. Construction of the new beach facility removed much of the vegetation below the 590 contour. The bluff, ravine and beach areas are part of an ongoing maintenance contract for invasive species.

The upper beach and toe of the bluff was restored and replanted following the construction of the new beach. Plantings were placed between the toe of bluff and boardwalk with establishment of a healthy suite of desirable native species. Grasses were planted throughout Rosewood Beach in select flatter, sandy areas. Some of these areas were not as successful at establishment; high water levels cut away the beach and beach users, likely unaware of restoration efforts, trample areas of residual plantings.

Figure 2.31 Rosewood Beach Recreational Cove, 2020

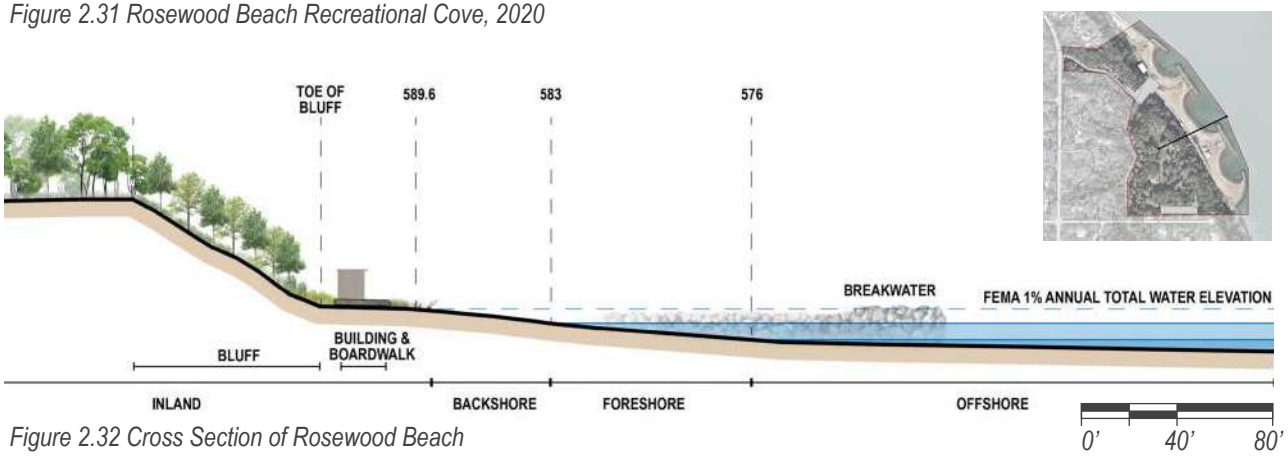


Figure 2.32 Cross Section of Rosewood Beach

Areas west of the bridge, over the ravine creek discharge, have been damaged by storm surges.

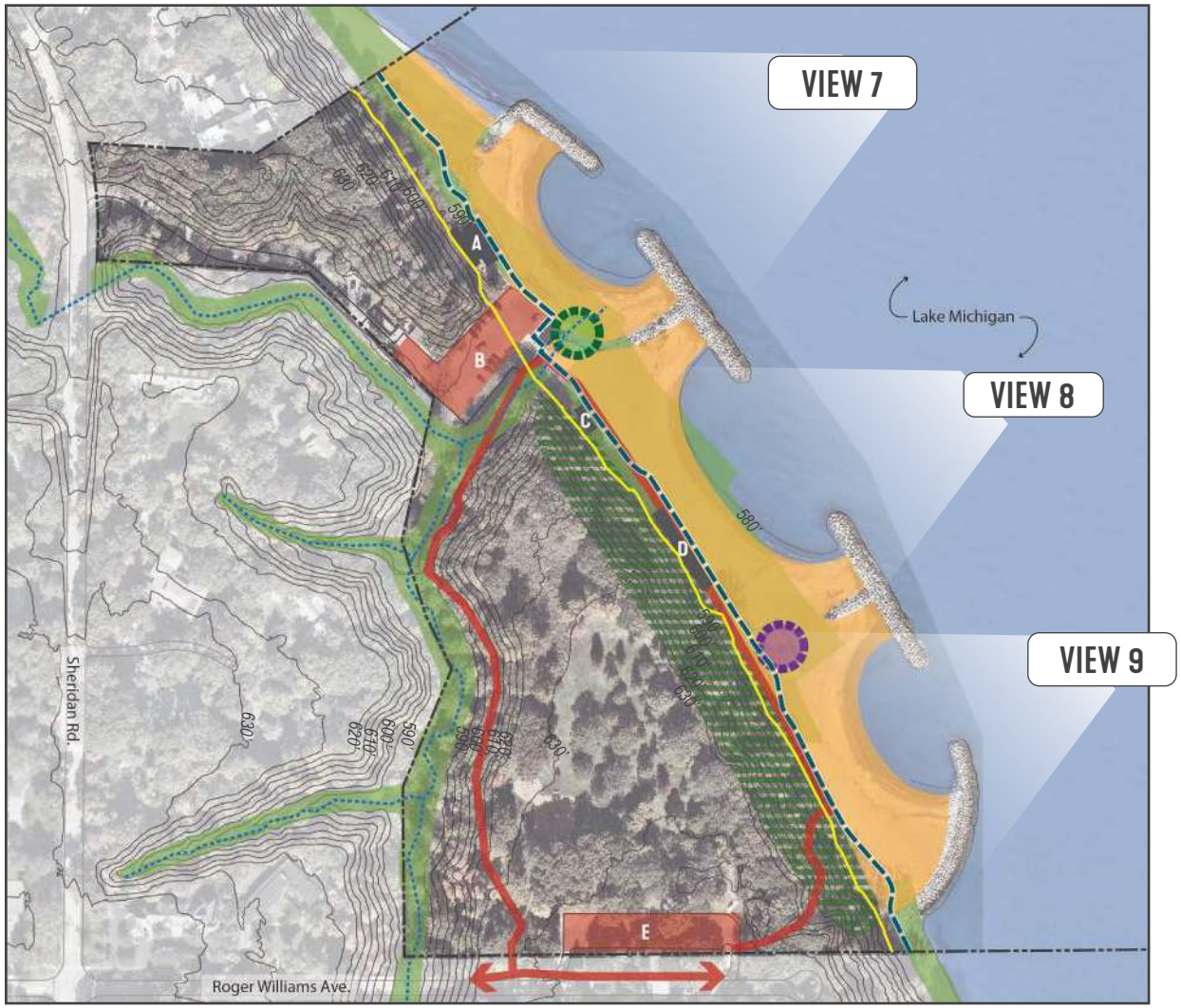


Figure 2.33 Existing Conditions at Rosewood Beach

3.0 RESOURCE INTERVIEWS

Resource Expert Interviews were conducted as part of this beach management plan. Interviewed experts included permitting and regulatory agencies and adjacent park districts or beach owners/managers.

Interviews with regulatory experts were focused on permitting, regulatory restrictions, guidance, and jurisdiction. Interviews with adjacent beach owners/managers were focused on practices they employ for managing their beaches, what they have found works for them, and practices they hope to implement.

US ARMY CORPS OF ENGINEERS (USACOE, CORPS)

Purpose & Role: USACOE is charged with preserving and protecting public safety and ecologically significant resources in and on the Great Lakes. They help maintain Great Lakes navigation, oversee the construction of coastal infrastructure and mitigate the risks of flooding. They are responsible for authorizing any filling, structures, or work waterward of the Ordinary High-Water Mark (OHWM) or landward structures that will affect the course, location, or condition of a waterbody.

Jurisdiction & Area of Influence: The Corps' jurisdiction begins at the OHWM. Historically that has been set at the 581.5' contour (datum, IGLSD 1985). However, more recently the Corps has been working with applicants to define the OHWM on site. The site defined OHWM is surveyed and shared with the Corps. The Corps has been providing a one-year authorization for the use of the site-defined OHWM. Guidance for the identification of the site defined OHWM is provided by the USACOE.

Landward of the OHWM is considered outside the jurisdiction of the Corps unless structures or activities are expected to impact a waterbody's course, location, or navigation. Any maintenance of beaches landward of the OHWM does not require Corps approval.

Regulatory Authorization: The Corps does not distinguish between maintenance and work lakeward of the OHWM. Any work in the OHWM requires authorization by the Corps. Authorization for work from the Corps is approved via two permitting paths, the Individual Permit or the Regional General Permit.

The Individual Permit is reserved for larger, more intensive waterward projects or projects that significantly affect the course or navigation of the water body. The Individual Permit is designed to be approved in 120-days. However, longer approval times are more typical. Most Individual Permits are approved in approximately 6-mos. Joint agency review is often the hold-up on an Individual Permit. Individual Permits are good for five years and can be extended if needed.

Effective October 1, 2020, many activities on Lake Michigan shoreline fall under the Corps' Lake Michigan Regional General Permit or other regional permits. This permit allows for the development or repair of groins and some offshore structures. The permit will result in a joint review by the Illinois Environmental Protection Agency (IEPA) Additional agency review is especially important when a large stormwater outfall is part of the project or beach.

The Regional General Permit is intended to take 60-days to approve if all parts of the application are prepared correctly and additional data is not required for approval. However, approvals can be delayed. The 60-day review is not a guarantee. These permits are good for three years, they cannot be extended.

The Corps will permit temporary protection structures in the state of Illinois. However, temporary structures must be maintained and removed within one year of installation.

Funding: There are some, limited funding opportunities from the Corps. They are governed by a different arm than the permitting approval arm. Most funding opportunities are directed at ecological restoration or improvement and are cost shared. Funding projects must be able to demonstrate improvement for the greater public good.

ILLINOIS DEPARTMENT OF NATURAL RESOURCES – OFFICE OF WATER RESOURCES (OWR)

Purpose & Role: OWR is the leading state agency for the planning, protection, navigation, floodplain management, water supply, and interstate organization of water resources. Their primary concern is urban flood reduction but also oversee and govern work on beaches.

Jurisdiction & Area of Influence: Generally, the OWR has jurisdictional responsibility for any work from the toe of a bluff to the lake. However, where the bluff is far back from the shoreline other conditions, determined by OWR, may be used to govern the jurisdictional responsibilities.

OWR is responsible for permitting any work on the beaches that is not considered routine maintenance. Repair of some structures such as rock structures may be considered routine maintenance and may not require permitting. Work should be reviewed with OWR to determine the scale and need for permitting.

Regulatory Authorization: OWR will generally permit any type of structure, except groins. OWR generally no longer permits the use of groins; repair of existing groins is permitted on a case-by-case basis. Any work expected to impact less than 300 linear feet of beach is typically permitted under a General Permit. Work expected to impact more than 300 linear feet or significant changes to or construction such as placement of stone, sea walls, or bulkheads would be permitted under the Individual Permit.

Construction permits are good for three years but can on a case-by-case basis, be extended to five-years. All permit applications with the OWR are forwarded to the Illinois Environmental Protection Agency (IEPA) for review and comment before approval.

Any work that will result in trapping sand at a beach requires establishing a 5-year monitoring program and pre-mitigation of the work at 120% of the expected impact.

Permit review and approval vary from two months to over a year.

Funding: There is not any kind of project funding through the OWR. Grant programs are available through the IDNR's Coastal Management Program.

WILMETTE PARK DISTRICT (WPD)

Beaches Managed: The WPD manages three beaches within the City's limit. Two beaches are owned by the Park District, the third beach is staffed by WPD, but not owned by the district.

Gillson Park is their largest beach, and the most visited and used. The park totals almost 60-acres. The beach includes swimming, sailing, a dog beach, beach activities, and site beach-related programming. The beach is accessible to residents and visitors to the City.

Langdon Beach is smaller, less visited, and used more by residents.

Management Activities: WPD works closely with non-profit organizations to help offset beach clean-up activities. Some groups are routine-biweekly participants, other groups provide routine-annual assistance. Groups assist the park district with site clean-up and removal of debris including microplastics.

Because the WPD beaches are used so frequently during the beach season they are groomed daily. The WPD is actively managing and restoring habitat areas on the beaches. These areas are signed and protected with fencing to notify beach users of the purpose and intent. However, they have found even with protection and signage restoration material can become trampled.

Beaches are winterized by piling sand in mounds to establish breaks for high-water wave action. They are regraded and spread before the start of the beach season. In addition, the park district fences beaches with New England-styled picket fencing to limit access and reduce the use of other types of fencing.

The park district owns and manages bluffs adjacent to their beaches. They do not actively manage the bluff; however, at the time of this interview, they were beginning a bluff management planning process. Included in this planning is the desire to manage the bluffs with desirable native species at appropriate vegetative densities.

The biggest management issue the park district wrestles with is the number of users on the beach. The beaches are very easy to access for residents and visitors to the area. This strains district resources.

Water Quality: Water quality at the beaches is impacted by gulls and other indigenous waterfowl. To help reduce impacts to the beaches WPD does not permit any food on the beaches. Beach users are directed to designated picnic areas. The policy is enforced by on-site park staff. Limiting food and subsequent garbage on the beaches has reduced water quality issues for the park district.

The WPD has found that they don't typically have beach closures because of water quality issues, their closures are typically associated with wave events, storms, or riptides.

Staffing: WPD staff all the beaches, daily during the peak beach season. At their largest beach, Gillson Park, there can be between 30-35 of which are dedicated to working at the beach during peak operation hours. Staffing numbers are determined by what WPD felt were necessary to safely manage and operate their beaches.

Their other beach, Langdon, is less visited and not staffed as heavily.

OPENLANDS

Beaches Managed: Openlands is a private, non-profit land stewardship, and management organization. They own and operate a beach north of Highland Park at Fort Sheridan. The site is a 77-acre preserve of restored ravine, bluff, and lakefront habitat.

Public trail systems are provided throughout the park and a staircase was installed to provide access down the face of the bluff to the beach habitats. The beach habitat extends about a mile in length along the shoreline.

The site is generally open to the public for trail use and passive recreational exploration. Swimming is not permitted at the preserve.

Management Activities: Because this site is dedicated as a nature preserve, management activities are directed at maintaining and providing access via on-site trails, control of undesirable species, and promotion and establishment of desirable native species and habitats.

Beach grooming or nourishment is not provided at the preserve. The condition of the beach, aside from the removal of human-made waste or debris, is governed by the influences of nature. Groins constructed before ownership and management by Openlands do contribute to sand collection and loss.

Recently Openlands has been developing some revetment installation and placement in response to an on-site washout in 2019. Revetment material was placed in the fall of 2020.

They are concerned about wave attack and impact on the bluff toe at their preserve and are interested in what other beach owners/managers are doing to protect and preserve the bluff toe.

Water Quality: Water quality testing is not conducted at the beaches. Users are permitted to bring and have food onsite while using the trail systems.

Staffing: The beach is not staffed.

4.0 MANAGEMENT RECOMMENDATIONS

(. . . with an understanding of beach and bluff lifecycle, stewards of shoreline property should work with nature to find a balance. It is with that understanding which the Park District approaches its beach properties.)

GENERAL COMMENTS

The following recommendations can be applied generally to all the beaches. Site-specific recommendations for each beach follow the general discussion.

Beaches are naturally dynamic. Without human intervention, shorelines are resilient; either shifting and returning or adopting to a new normal. Sandy beaches alter with changing water levels and bluffs steepen and collapse providing new sediments to the shoreline. Interruptions to these processes is when we see irreversible changes occur. Even then, the shoreline changes to adapt to this new normal.

However, where access is desired, strategies for offsetting and controlling the natural regimes may be required. If the beach is present for one season and gone the next it has a significant impact on how users of the beach can interact with the lake.

Climate change and human development have forever changed the shoreline of Lake Michigan. Few areas remain 'natural' and those areas are the first to react to changes in the system. None of the beaches managed by the Park District of Highland Park are in their natural states; they all contain some type of man-made intervention to alter their natural behavior. Along much of the southwest coast of Lake Michigan, this desired altered behavior is to prevent natural bluff failure and maintain a protective sandy beach. The beach, while enjoyable for human recreation, is a natural defense barrier in front of the bluffs; breaking the wave energy before it can reach the bluff toe. Its inherent job is to absorb the energy of breaking waves and dynamically does this through shifting and moving in both cross-shore and long-shore directions. And like a shock absorber, it would be foolish to try to make a beach static. Instead, with an understanding of beach and bluff lifecycle, stewards of shoreline property should work with nature to find a balance. It is with that understanding which the Park District approaches its beach properties.

Beach Management

Maintaining the beaches in a safe and healthy condition is a priority for all the beaches. Continuing to clean, clear, and regroom beaches, where possible, following storm and wave events and at the beginning of the beach season should be continued at all the beaches, when they are open to the public.

Currently, Lake Michigan is in the third year of higher than average lake water level cycle. Historically these higher lake level have more or less followed an average of a five year cycle. The lake rises over the course of five years, typically peaking around year-three, and then begins to fall back to normal water levels. If the lake follows historical trends higher water levels could begin to diminish in the next year or two. However, there is no guarantee this cycle will follow other historic cycles. Climate change, increased urbanization and subsequent runoff, and other perturbations exacerbated by development have and continue to impact the lake.

It is expected that when the lake levels begin to drop, currently submerged areas at the four beaches will emerge. As beach emerges and lake levels drop the threat to bluffs caused by wave attacks should diminish. In addition, sand loss because of cross-shore sediment transport is also expected to decrease.

Strategies that might be employed during periods of normal lake levels may not be appropriate or cost effective during the current period of higher water levels. For example, placement constraints of nourishing beaches during higher water levels results in quick flattening of the newly placed sands where additional nourishment will be more frequently needed. When lake levels are higher the forces that impact beaches, sediment transport, and wave action can undo placement of sand or beach nourshiment.

The shoreline of Highland Park is starved of sand. Updrift development and stabilization of bluffs has significantly reduced the amount of sediment in the littoral system. Because of this, the delicate balance of sediments in the system versus the rate of sediment transport is no longer in equilibrium. In lieu of more structural interventions, more natural approaches, such as beach nourishment, can be used as a strategy of shoreline defense. However, it should be recognized that without fundamental changes to the materials placed on the beach, such as an increased grain size, the forces that removed the sands will continue to erode the newly placed material, particularly during periods of high lake water levels.

Structures that could prevent the types of wave action and events that erode beaches or undercut bluffs can be installed. These structures must be designed mindful of the full range of water levels at the site as they may inadvertently result in functional, aesthetic, or even safety issues at low water.

The strategies presented in the following sections are based on a review of the conditions found at each beach. Any changes to current shoreline structures requires the review, analysis, and design of a licensed coastal engineer to minimize future risk to the site and adjacent neighbors.

In the absence of any type of beach management, the beach sizes and presence will be subject to the outcomes of cross-shore sediment transport and other lake effects. The existing groins reduce the rate of cross-shore sediment transport, however, the groins at Moraine and Millard are aging. Replacement of the existing groins with new steel groins is unlikely, generally speaking, the ASCOE no longer permits new groin construction or replacement, however, repair of existing steel groins is allowed.

Because the beaches are dependent on the groins for the presence of sand, and because new steel groins will not be permitted should the existing groins begin to fail, the existing groins at Moraine and Millard beaches should be inspected annually to document structural integrity and needed repairs. Inspection does not require any kind of permitting and should focus on identifying and documenting changes in the structural

integrity of a groin by visual estimation or sounding (tapping with a hammer). Inspections should look for perferations along the length of a groin, perferations greater than 4" in diameter, flaking, and evidence of cross shore transport of sediment behind the upland portions of a groin. Significant, noticable change in a groin year to year is indication closer inspection by a structural engineer is required.

Inspection documentation of the groins can be accomplished with hand mark-ups of drawings illustrating the groin and photos collected during inspections. If inspections identify the need for groin repair within the OHWM, an ASCOE nation-wide permit will be required.

Extension of an existing groin inland of the shoreline to prevent cross shore sediment transport behind a groin may require IDNR permitting, if the extension is expected to impact existing habitat.

Bluff Management

Once made unstable through failure at the toe or slippage on the slope, bluff disturbance tends to continue until the area reaches its "angle of "repose" or relative stability. This may appear as small surfical slumps on the bluff or full toe to crest slip failures. Evaluating the trajectory of this natural process with respect to public safety and protection of resources is key to best management practices at the bluffs.

The bluffs at Moraine Beach, parts of Park Avenue Boating Facility, and Millard Beach, are threatened by wave attack, resulting in toe undermining. In addition, horizontal groundwater movement over less permeable layers may be loosening the friction between soil particles especially while lake water levels are high. Stabilizing the bluffs within the PDHP's lakefront properties is not an easy task due to their relative size and steep slope. Commonly, the toe of a bluff is protected by installation of a seawall or rubble revetment. While this prevents waves from eroding the base of the bluff, if the bluff already has instabilities along its face or through deeper subsurface layers, this will not mitigate these failures. Other strategies for stabilizing unstable bluffs include bluff anchoring, pinning, cutting back the slope to a stable condition, among others. Due to the height of the bluffs in the lakefront properties managed by the Park District, these options will be expensive and should be reviewed and evaluated with the help and analysis of a geotechnical engineer knowledgeable about bluffs.

To mitigate slope surface runoff erosion, stormwater and overland flow should be redirected from bluff edges. Overland flow of table land runoff at the top of the bluff including impervious surfaces graded toward the bluff or building downspouts that face the bluff should be redirected from the bluff face. Overland flow can be further hindered by planting native buffers along the top of the bluff.

An additional threat to the bluffs is an overabundance of canopy trees which limits ground vegetation. This is particularly an issue in Moraine and Millard Beaches. Stormwater runoff down the bluff face can more easily lift and pull away exposed soft soils creating weaknesses on the bluff face. Contrary to popular belief, trees do not have soil stabilizing root structures. Shallow root systems of trees combined with their above ground mass on the steep faces of the bluffs can result in ripping the protective ground cover from the bluff face if the tree starts to lean or fall. This allows for water to work its way into the soft soils. On the other hand, native perennial vegetation, adapted to these vegetative conditions, can have rooting depths that exceed 6' in depth.

Following storm or wave events the bluffs at Morain, Park Ave, and Millard Beaches should be visually inspected for evidence of toe erosion; sand removal or mining at the toe; rills, gullies or erosion carving on the face of the bluff or across the beach; bluff slope slumping or slipping; liquefaction of soil at the top of the bluff or on the bluff face; and evidence of trees on the bluff or top of bluff pitching toward the lake. Changes should be documented with site plan notes and with photographs. If conditions appear to be unsafe, the area should be closed and marked to prevent user access until conditions can be reevaluated or safe conditions can be restored.

Strategies For Managing Bluff Erosion:

- Examine bluff toes for undermining and evidence of hazardous conditions after severe storm or wave events or when water is known to impact the bluff toe.
- Restrict access at the top and toe of bluffs where undermining has been found.
- Review stormwater runoff on the site and capture or redirect overland flow from going down the slope.
- Restore and manage appropriate native habitats on the bluff faces.
- Work with City Forestry Department to open canopy on lake bluff to promote vegetative growth on the surface. Include consideration of native shrubs such as common juniper, white cedar, and hazelnut as replacements for tree cover.
- Adaptive management practices including annual control of invasive woody and herbaceous species, prescribed burns and overseeding with appropriate native species as needed.

PUBLIC ENGAGEMENT

In keeping with the Park District's community engagement tradition, the draft recommendations were presented to the community at a public Board meeting as well as through an on-demand online video. The video presentation provided an overview of the plan and was posted on the Park District website. Notice of the presentation was posted on the Park District of Highland Park homepage which receives on average 720 visitors daily. Comments were accepted from March 10th through March 18th.

MORAINE PARK

Moraine Beach shall remain a natural beach with little intervention. The primary focus will be maintenance of existing structures, regular reviews of the shoreline for cleanliness and refuse removal, re-establishment of the access pathway, and public safety.

The sandy shoreline of Moraine Beach is primarily held along shore in a closed cell by the groins extending up and down this stretch of coastline. As there is little littoral supply from the north, removal of the sheetpile groins without further efforts to stabilize the shoreline is not recommended. As such, inspection, maintenance, and repairs to the groins should be made at regular intervals.

The bluff toe located behind the beach is within reach of the 1% annual chance total water elevation. The high-water levels of 2020 combined with larger storm events resulted in erosion of vegetation located at the bluff toe and indicate that the toe is at risk of damage. Bluff instability is a possibility if the damage becomes severe. However, bluff failure at this location would have few negative impacts on the beach becasue there are no park facilities located at the top of the bluff. Failure of the bluff could result in periodic beach closure. Immediate evaluation of the bluff and intervention is not necessary. If undercutting of the bluff toe were to persist a geotechnical analysis may be required.

The ravine outfall at this beach occassionally becomes plugged with depositional sand. This is a natural occurance because of the wave action along the beaches. A US Army Corps of Engineers report that examined the ravine creek and restoration opportunities was preapred in 2020 and can be referenced. It is not necessary to clear the outfall when it becomes plugged.

While the programmed uses of Moraine Beach are limited during periods of higher water level, the beach itself remains stable and will resurface once water levels recede. It is recommended that the beach be closed during high water levels to protect public safety.

Recommendations	Activity Period		Frequency			Permitting	Cost
	Short Term/ On-Going	Long Term	Regularly	As Needed	One Time		
1. Bluff & Beach Management							
a. Visually inspect the sand beaches at least twice weekly and remove refuse.	X		X			N/A	α
b. Maintain waste receptacles and dog waste bag dispenser when beach is operational.	X		X			N/A	α
c. Close the shoreline when water levels severely limit recreational activities.	X			X		N/A	α
d. Monitor bluffs for stability following major storm and wave events.	X			X		N/A	α
e. If toe erosion of the bluff persists or if severe erosion is observed following a post event inspection, perform a geotechnical review of the lakeshore bluff to identify areas of instability.		X			X	N/A	$ 18-26,000
f. Clearly mark areas of highest instability to prevent user access.	X			X		N/A	α
g. Review bluff vegetation with City Forestry Department and develop maintenance plan to promote desirable native ground cover growth.		X			X	N/A	β
h. Remove leaning or fallen trees from bluff slope.		X		X		N/A	β
i. Annually inspect existing steel groins and document visual evidence of changes in the structural integrity.	X		X			ACOE	α
j. Repair existing groins to maintain function		X		X			β
2. Access							
a. Repair the trail to the beach.		X			X	IDNR	β
b. Replace existing wooden steps		X			X	N/A	β

α = Operational budget impact
β = Budget impact to be determined through further investigation

Description of Recommendations

Moraine Beach is a passive recreation area that permits off-leash dog activity. Stewardship of this site will be guided by adaptation to climate, and therefore the plan does not recommend significant beach or bluff management interventions. Routine, regular cleaning of the beach is all that is needed to maintain the health of this beach. Because access is limited, grooming and grading cannot be performed on this beach. Regular removal of debris and twice weekly inspections of on-site conditions should be sufficient to maintain the quality of this beach.

However, because this beach is exposed to regular wave attack diligent review and inpsection of the beach and toe of bluff is needed to maintain safe conditions.

Inspect the lakefront bluff face and bluff toe following severe storm or wave events. Bluff inspections should follow the guidance outlined in the Beach Management portion of the General Comments for Management Recommendations, above. Should bluff toe erosion persist or exacerbate following a storm or wave events, a geotechnical analysis of the lakefront bluff should be performed by a qualified, licensed engineer. The geotechnical analyis should evaluate bluff stability and risks, recommend solutions, identify expected permitting needed to repair or protect the bluff and provide an engineer's opinion of probable cost for the construction of repairs or protection.

The bluff at this beach is heavily vegetated. A plan should be developed with the City Forestry Department to maintain healthy vegetation levels and promote desirable species. Because access is limited at this beach work will need to be done by hand.

The steel groins at this beach are aging. They should be inspected annually to determine their condition and expected longevity. Groin inspections should follow the guidance outlined in the Beach Management portion of the General Comments for Management Recommendations, above.

If a groin fails at this beach an evaluation will need to be conducted to determine the expected impact of the groin loss and evaluate replacement options. The beach is dependent on the groin at this location to remain.

Access to the beach cannot be accomplished without first repairing the trail to the beach. The trail should be repaired and reopened. A design for the replacement of the trail will determine the expected permitting needed to complete the project.

Finally, the existing wooden stairs from the top of bluff in Moraine Beach to ravine bridge crossing should be replaced. During the site inspection of this beach the stairs were found to be mushy, split, and face rotting in places.

Figure 4.1 Collapsed trail to Moraine beach

PARK AVENUE BOATING FACILITY

Park Avenue Boating Facility offers active recreation opportunities, and intervention may be required to maintain access and programming. Park Avenue Boating Facility includes the most stable of all of the Park District's beaches; the north beach used for passive recreation. The boating beach, though narrowed, is inundated during high water but otherwise remains stable. Therefore, no large structural changes are needed and management updates are minimal.

The north beach of Park Avenue is stable and does not require any intervention to hold sand along the shoreline. The dry beach will naturally narrow due to inundation during high water levels and return to its former state once the water levels recede.

The parking lot adjacent to the northern beach has an approximate elevation of 590. High water levels, plus surge and wave setup, has resulted in wave runup onto the parking lot. This is evidenced by the sand seen on the pavement during the summer of 2020. Rubble and larger stones along the edge of the parking lot suggest a buried revetment was at one time installed to protect the parking pad and has since become damaged. Due to the lakeward slope of the parking lot, occasional wave runup is not a cause for concern. However, based on the damage observed to the revetment and the sharp grade change, reconstruction/rehabilitation of the revetment is recommended.

For the protection and longevity of the boating beach, the dilapidated barge or a replacement groin structure must remain adjacent to the boat launch. Should the barge be replaced, it should be approximately the same length in order to maintain a similar beach profile. By installing a longer structure and preventing overtopping in storm events, the dry beach width will be increased at high water level.

While the beach thins at higher water level, the established programming of the boating beach remains possible. Reduced dry sand limits the storage of boats on the beach. Upland storage options would offset this issue.

Recommendations - North Beach	Activity Period		Frequency			Permitting	Cost
	Short Term/ On-Going	Long Term	Regularly	As Needed	One Time		
1. Bluff & Beach Management							
a. Repair existing buried revetement around the north beach parking lot	X				X	N/A	$ 750-2,000/ linear foot
b. Groom and regrade the beach at the beginning and end of the beach season, annually to aerate the sand, remove debris, and promote beach health.	X		X			N/A	α
c. Groom the beach 2 to 3 times during the beach season.	X		X			N/A	α
2. Ecological Improvements							
a. Plant and protect desirable beach species. Use fencing or other structures to control and reduce user access in planting areas.	X				X	N/A	β
b. Visually inspect native planting areas regularly for evidence of damage. Replace dead or dying desirable species when needed.	X			X		N/A	α
c. Continue to control invasive and other undesirable species on the beaches.		X		X		N/A	α
d. Evaluate the opportunity for establishment of a native wetland at the ravine outfall to capture some of the discharge leaving the pipe.		X			X	N/A	β

α = Operational budget impact
β = Budget impact to be determined through further investigation

The bluff toe at this property is much further from the shoreline than at the other lakefront properites. Wave runup and attack is not a threat to the bluff at this property except at the far northern and southern ends of the beach.

Description of Recommendations

Park Avenue Boating Facility offers active reaction opportunities and access to the lakefront. Protecting the existing built infrastructure may require intervention as the lake experiences climate-driven changes.

Repair of the existing revetment around the north beach parking lot should be prioritized to protect the lot. Resetting existing fallen stones and restablishing the exisitng revetment will not require permitting. However, if additional work is found to be needed, a permit from the IDNR may be needed depending on the repair required.

Grooming the beaches at the beginning, end, and throughout the beach season will aerate the sand, remove debris, and promote the health of the beach.

Establishing desirable native vegetation, where appropriate, will help promote the ecological value of the beach. Discouraging

Recommendations - South Beach	Activity Period		Frequency			Permitting	Cost
	Short Term/ On-Going	Long Term	Regularly	As Needed	One Time		
1. Bluff & Beach Management							
a. Repair or replace the boat launch with a structure of similar length to maintain the boating facility beach. Extending the length of the groin will aid in widening the beach.	X				X	ACOE	β
b. Store beach crafts and facility infrastructure away from the water's edge.	X				X	N/A	N/A
c. Use racks and other storage devices to offset dry beach space limitations during high lake water levels. Racks should be placed behind the FEMA 1% Chance of Flood Line.	X			X		N/A	$4-6,000/boat rack
d. Repair and install scour protection around the North Shore Yacht Club boat parking lot pad. The southeast corner of this pad is within the area of influence of lake inundation and wave impact.	X				X	ACOE/IDNR	$ 750-2,000/ linear foot
e. Develop stormwater control plan to protect the parking lot from upland runoff causing scour and erosion.		X		X		N/A	β
f. Groom and regrade the beach at the beginning and end of the beach season, annually to aerate the sand, remove debris, and promote beach health.	X				X	N/A	α
g. Groom the beach 2 to 3 times during the beach season.	X			X		N/A	α

α = Operational budget impact
β = Budget impact to be determined through further investigation

Figure 4.2 Remnant revetement stones on the north beach

unwanted invasive species, including undesirable native species, should continue at the beach. A large, somewhat under-utilized, portion of the northern beach from the ravine oufall structure to the City's water plan appears to be an ideal location for establishment of desriable beach habitat.

Key to maintaining the beach at the south end of the Park Avenue Boating Facility is maintaining or replacing the existing sunken barge. If replaced, a larger groin would promote a deeper beach. Replacement of the barge will require permitting by the ACOE.

Using boat storage racks at the south beach will free up beach space for boat launching. Racks should be placed behind the FEMA 1% Chance of Flood Line (Figure 2.14).

The parking lot at the North Shore Yacht Club needs to be restored and protected. Depending on the type of scour protection developed permitting will be required. An evaluation of the expected permitting should be prepared as part of the design for the scour protection.

MILLARD BEACH

Millard Beach shall remain a natural beach with little intervention. Of the four Park District beaches, Millard has suffered the most significant shoreline damage due to the naturally-occurring high-water levels of 2019 & 2020. The toe of bluff throughout much of the property is within the height of runup and wave attack and therefore is within jeopardy of toe erosion. The park includes eight shore-perpendicular groins and an old building foundation, which partially contain the soft sediments along the shoreline but were not sufficient to accommodate the high-water levels of 2020. High water and waves resulted in erosion of the sandy protective beach, significant damage to the bluff toe, and bluff collapse in two locations on the north end of the property.

All of the groins are over 50 years old and exhibit signs of damage. Though their design criteria is unknown, it is unlikely they were designed to accommodate the water levels and combined storm events experienced between 2017 – 2020. They are not dilapidated and will still provide protection and sand retention along the shoreline during average and low water levels, but cannot be relied upon for bluff protection at higher water elevations. Though damaged, removal of the groins without replacement with other coastal stabilizing features will result in more widespread bluff damage and failure at all water levels. Enhancement of the groins for current and future water levels and storm events would provide better protection to the bluffs.

The remnant building foundation, though overtopped in high water levels, does act as a sediment trap. Though the beach has been reduced, Millard Beach retains areas of dry beach at high water elevation which still allows for passive recreation.

Historical imagery indicated shoreline protection systems were installed along the bluff in some areas which are now covered by sand. A catalogue of these historical structures and their useful life would help inform decisions regarding future bluff stabilization efforts.

Recommendations	Activity Period		Frequency			Permitting	Cost
	Short Term/ On-Going	Long Term	Regularly	As Needed	One Time		
1. Bluff & Beach Management							
a. Groom and regrade the beach at the beginning and end of the beach season, annually to aerate the sand, remove debris, and promote beach health. Use caution to avoid existing native plants.	X		X			N/A	α
b. Groom the beach 1 to 2 times weekly during the beach season.	X		X			N/A	α
c. Perform a geotechnical review of the bluff to identify areas of bluff instability. Develop a long-term bluff mitigation strategy plan.	X				X	N/A	$ 18-26,000
d. Where possible, move top of bluff trails, structures, and property furnishings back from the head of the bluff.	X				X	N/A	β
e. Monitor bluffs for stability and safety concerns following major storm or wave events.	X			X		N/A	α
f. When necessary, erect fencing and signage prohibiting users from accessing areas deemed unsafe at the top or bottom fo the bluff.	X			X		N/A	α
g. Annually inspect existing steel groins and document visual evidence of changes in the structural integrity.	X		X			N/A	α
h. Repair existing groins to maintain function							β
i. Budget for mitigation from damages resulting from passive bluff protection approaches.	X		X			N/A	β
j. Conduct appropriate vegetative management of the bluff	X			X			β

α = Operational budget impact
β = Budget impact to be determined through further investigation

Description of Recommendations

As Millard Beach currently provides passive recreation, and has limited access capcity, it is recommended that Millard Beach shall remain a natural beach with little intervention. Mitigation for damages resulting from passive bluff protection approaches, such as top of bluff trail erosion, should be accounted for in the annual park budget.

Repair or protection of the bluffs would be very costly at this location. With bluffs approximately 70' in height, interventions would be major and require removal and regrading of much of the lakefront bluff.

Recommendations	Activity Period		Frequency			Permitting	Cost
	Short Term/ On-Going	Long Term	Regularly	As Needed	One Time		
2. Access							
a. Install bike parking at the beach and in neighboring Millard Park.	X				X	N/A	$500/bike rack
b. Explore access control to the parking lot. Evaluate parking options and limited parking access.	X				X	N/A	β
3. North Shore Sanitary District Sewer Line							
a. Place coarser sand within the sanitary sewer channel to reduce the risk of pipe exposure.		X		X		ACOE	$ 28-30/ cubic yard
4. Stormwater Oufall							
a. Develop a native wetland area on the beach where the adjacent property owner oufall crosses the beach to better control erosion.		X			X	IDNR	β
5. Ravine Oufall							
a. Continued to add and protect native species in the ravine waterway.		X		X		N/A	β

α = Operational budget impact
β = Budget impact to be determined through further investigation

Because of the bluff failure at the northern end of Millard Beach in 2020, a geotechnical review of the bluff stability throughout the beach is recommended. Continued failure of the bluff, particularly along the north portion of the beach where Millard Park and public access extends up along the top of the bluff, will continue to threaten top and bottom of the bluff access. Where possible, existing trails, structures, and park furniture should be pulled back from the top of bluff.

Inspect the lakefront bluff face and bluff toe following severe storm or wave events. Bluff inspections should follow the guidance outlined in the Beach Management portion of the General Comments for Management Recommendations, above. Should bluff toe erosion persist or exacerbate following a storm or wave events or should additional bluff failures occur the area should be fenced to restrict user access. A geotechnical analysis of the bluff should be performed by a qualified, licensed engineer. The geotechnical analyis should evaluate bluff stability and risks, recommend solutions, identify expected permitting needed to repair or protect the bluff and provide an engineer's opinion of probable cost for the construction of repairs or protection. At this beach, where table land runoff is suspected of contributing to bluff instability, it is recommended the geotechnical analysis should also include a subwatershed evaluation of the runoff areas directed toward the bluff.

In the absence of any kind of repairs or protection to the bluff, or if the PDHP choose to use a more passive approach to manage the bluff, PDHP should budget annually for the repair or mitigation from bluff erosion events.

Inspect the groins annually and document their condition. Groin inspections should follow the guidance outlined in the Beach Management portion of the General Comments for Management Recommendations, above.

Install bike parking at the beach and in neighborhing Millard park to provide for a safe way for beach users to store their bikes while at the beach.

In addition, because of the small size of the parking lot and because there is no room for improving the parking at Millard beach, PDHP should explore strategies for restricting vehicular access at the beach.

The North Shore Sanitary District Sewer Line has been exposed in some places because of sediment transport and sand loss. To protect the line, sand needs to replaced over the line. A coarser, less easily eroded sand is recommended. Because this work will be conducted at the water's edge an IDNR permit will be required for placing the sand.

Finally, where the adjacent property owner discharge crosses the beach on the southern portion of the beach, the PDHP should develop a native wetland to better control the runoff, reduce beach erosion, and control storm surges from the outfall in that area.

ROSEWOOD BEACH

Rosewood Beach is the only public swimming beach in Highland Park. The beach hosts many active recreation programs including camps and has the largest parking capacity of all four of the beaches. As such, to maintain level of access and programs, interventions are likely to be required. As the most prominent of all the Park District's beaches, the majority of management fund should be directed toward its care and continued function. As recognized since its construction, these maintenance and management needs are greatest during periods of above normal water levels.

Significant investment went into the redevelopment of the shoreline in 2014-2015. Following any large changes along the shoreline, the area enters a stabilization period where the disruption of the littoral system adapts to the new normal. This can take a few years, during which time settlement and sifting of the newly constructed/placed shoreline materials will be recognized. In the case of Rosewood Beach, the construction of the beach occurred following a 15-year period of low water directly followed by a historically fast rate of change to record high water levels. While this affected the entirety of the Lake Michigan shoreline, the effects on Rosewood Beach were swift. Newly placed beach sand within all three coves was pulled outside the protective breakwaters and entered the downdrift littoral system. This left steep-faced beaches above the still water line and significant landward movement of the top of beach slope as large waves carved away at the beach face. This reaction is a typical response to higher water levels.

When the beach recession started to reach the property infrastructure, the Park District of Highland Park made the decision to place nourishment sand within each cove to protect the boardwalks and foundations from direct wave attack. This is considered a softer, more natural response though is at higher risk of erosion as water levels and wave events remain high. This results in frequent sand re-nourishment to maintain the protective barrier around the property's infrastructure. As water levels recede, the need for periodic nourishment will greatly reduce and the coves will begin to fill naturally with sands from the littoral system.

To further mitigate the risk of damage to the property's infrastructure, harder protective barriers, such as riprap revetments, can be placed around these structures. Such as with the riprap revetment exposed in Park Avenue beach, these structures can be hidden below the sand surface and not interfere with typical beach operations and use. They provide a safety barrier for when high water levels naturally return. However, while these types of structures protect features landward of them, they can be overtopped in extreme high-water situations and do not assist in retaining soft sediments.

Because Rosewood Beach is the Park District's only swimming beach, water quality is very important. Monitoring is provided by the Lake County Health Department through the federal Beaches Environmental Assessment and Coastal Health (BEACH) Act. Funds allocated to Illinois since its creation have been decreasing. Therefore, having a plan in place for how this effort may be funded at Rosewood Beach, if not at all four beaches, in the future will prevent any gap in monitoring should these funds be depleted or repealed.

Recommendations	Activity Period		Frequency			Permitting	Cost
	Short Term/ On-Going	Long Term	Regularly	As Needed	One Time		
1. Bluff & Beach Management							
a. Reduce damage risk to existing structures by installing foundation protections, such as riprap revetment, around at-risk structures.	X			X		ACOE/IDNR	$ 750-2,000/ linear foot
b. Develop and maintain a beach re-nourishment program, identifying areas of greatest concern, volumes, and environmental and site triggers. Maintain a budget to allow for a cyclical nourishment program during periods of high lake water levels.	X		X			N/A	β
c. Groom and regrade the beach at the beginning and end of the beach season, annually to aerate the sand, remove debris, and promote beach health. Use caution to avoid existing native plants.	X		X			N/A	α
d. Continue to groom the beach 2 to 3 times weekly during the beach season.	X		X			N/A	α
e. Annually inspect breakwaters for visual signs of slumping or rock plucking. If evidence of damage is found, consult coastal engineer to determine severity and whether repairs are required to maintain function.	X		X			N/A	α
f. Prepare a plan for future funding of water quality monitoring at Rosewood Beach should current funding be depleted or repealed.	X				X	N/A	β
g. Regularly monitor bluffs for stability and safety concerns.	X		X			N/A	α

α = Operational budget impact
β = Budget impact to be determined through further investigation

Recommendations	Activity Period		Frequency			Permitting	Cost
	Short Term/ On-Going	Long Term	Regularly	As Needed	One Time		
2. Ravine Outfall Improvements							
a. Restore erosion areas in the Nature Cove and ravine stream oufall.	X			X		ACOE/IDNR	β
3. Ecological Improvements							
a. Define, protect, and maintain beach habitat restoration areas.	X				X	N/A	β
b. Use appropraite fencing or other structures to restore patches of beach habitat and limit user impacts.	X				X	N/A	α
c. Erect signage around fenced areas to educate the public on why these areas are protected.	X				X	N/A	β

α = Operational budget impact
β = Budget impact to be determined through further investigation

Description of Recommendations

Due to the programmed activity supported at Rosewood Beach, interventions are recommended to maintain access. High lake water levels and subsequent wave runup and erosion have threatened the existing infrastraucture in places. To protect the investment in these structures, foundation protection should be placed to protect against undermining or other forms of damage.

Working with a consultant, the Park District has already explored design protections for existing infrastructure . Back of the beach revetments for the Interpretive Cove are currently in the final design phase. The Park District does not have plans at this time to install these revetments. Depending on the design of the protection, and the placement of the protection, permitting will be required by the UASCOE and/or the IDNR.

Because this is the Park District's swimming beach, a plan for on-going beach nourishment should be developed. The plan should include regular evaluation of the beach, particularly during periods of high lake water levels. A budget for nourishment should be maintained if and when nourishment is needed at the beach. Planning and budgeting for this work will not require permitting, however placing nourishment will require a permit from the IDNR. The Park District currently has a 10 year beach nourishment permit for Rosewood.

The beaches at this park are dependent on the break waters to protect against erosion and beach loss. The breakwaters should be inspected annually for signs of slumping or rock loss. If inspections find evidence of concern, a coastal engineer should be consulted to determine the severity of the damage and evaluate the need for repairs. Inspections of the breakwaters will not require permitting. If the breakwaters are in need of repair, permitting may be required, depending the severity of damage. The consulting coastal engineer will be able to determine the expected repairs, estimate the cost for repairs, and determine if permitting will be required.

Plans and budgeting should be identified to maintain water quality testing at the beach if funding should be depleted or repealed. The PDHP should evaluate the cost for budgeting testing costs in-house or review alternative program opportunities with other funders such as the state or county.

Some portions of the Nature Cove and ravine outfall have been eroded by the high lake water and should be restored, including the ravine stream outfall. High storm flows and high lake water levels resulted in several areas where the banks have collapsed. The streambanks should be restored with rocks suited for the sheer stress caused by high runoff events and replanted with appropriate native species. Restoration plans and cost estimate of the work to be prepared should be developed. Execution of the restoration is expected to require USACOE permitting.

Several desirable beach habitat areas have been damaged by high lake water level erosion and wave run up, and the damage has been exacerbated by user impacts. These habitat areas should be restored and reestablished with appropriate native species. In addition, protective fencing and signage should be placed to protect against additional user impact.

5.0 REGULATORY OVERVIEW

Permitting is a complex process that requires coordination with federal, state, county and local regulatory agencies. The three main permitting agencies that will be involved in implementation of the recommendations in this document include the U.S. Army Corps of Engineers (USACE), Illinois Environmental Protection Agency (IEPA), and Illinois Department of Natural Resources (IDNR). While the permits for these agencies are written jointly, the focus of each agency differs during the review process.

As the beach management plan moves forward into implementation, the permitting discussion should be continued with these regulatory agencies.

FEDERAL PERMITTING REQUIREMENTS

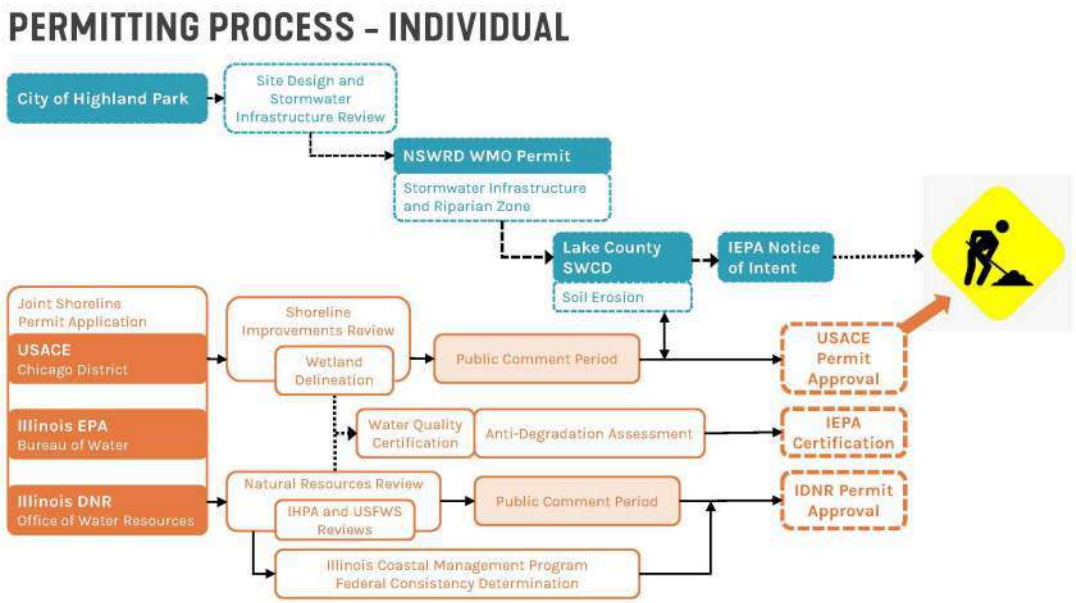
U.S. Army Corps of Engineers (USACE)

- USACE Section 10 governs any work within the ordinary high water mark (OHWM). USACE Section 404 permitting is required for the discharge of dredged or fill material into waters of the U.S. Depending on the established OHWM, site improvements such as the boardwalk and stormwater improvements may trigger USACE Section 10 and Section 404 permitting.

- The USACE recommends a pre-application meeting prior to review the project scope and permitting requirements prior to submitting an application. There are two basic types of Section 404 and Section 10 permits. Construction activities not covered by standing regional permits will require an individual permit. Early applications are encouraged, since processing time can take 3-6 months.

- Any impacts found to be ecologically adverse will require mitigation efforts.

- Activities that will require USACE permitting include: Sand grooming below the OWHM, sand nourishment, dredging, and construction of boardwalks (or other structures) through designated wetlands.



STATE PERMITTING REQUIREMENTS

Illinois Department of Natural Resources (IDNR)

- Any construction activities along the Lake Michigan shoreline that are located at or below the OHWM or within designated wetlands will require a permit from the IDNR Office of Water Resources (OWR).

- IDNR permits are categorized into statewide, regional and general permits. The statewide and regional permits describe a general project type and set limits on the scope of the work. If the proposed work meets all the specified limits, the project is approved under the statewide or regional permit. For projects covered by a statewide or regional permit, one does not need to submit a permit application. General permits similarly cover a specific type of project and are limited in scope. For projects covered by a general permit an application submittal is still required.

- Activities that will require IDNR permitting include: Construction within wetlands or below the OHWM, and disturbance of areas in which an endangered or threatened species has been identified

Illinois Environmental Protection Agency (IEPA)

- The Illinois EPA is responsible for protecting and enhancing the state's natural resources and is divided into three bureaus which require permitting: Air, land and water.

- The Illinois EPA (Agency) issues water quality certifications pursuant to Section 401 of the federal Clean Water Act (CWA). This certification must be granted or waived prior to issuance of any federal permit that authorizes a potential discharge of dredged or fill material to a waters of the U.S. The Agency's technical review focuses on potential impacts on water quality caused by the proposed construction and alteration of the waterbody.

Illinois Coastal Management Program (ICMP)

- Projects may also need federal consistency determination from ICMP for federal funded or permitted actions to determine if activities are compliant with state law.

- No fee or application form is required. A federal consistency application is initiated when the ICMP receives one of the following: A consistency determination from a federal agency conducting an activity, a copy of an application for a federal license accompanied by a federal consistency certification, or a copy of an application for federal financial assistance accompanied by a federal consistency certification.

LOCAL PERMITTING REQUIREMENTS

Lake County

- A Health Department review is recommended for proposed swimming and dog beach enhancements.

- The Stormwater Management Commission regulates development within the 100 year floodplain and isolated wetlands above the OHWM. A Lake County Watershed Development Permit (WDP) is required for any development that proposes to impact Waters of the United States (WOUS) or Isolated Waters of Lake County (IWLC).

ANTICIPATED PERMITTING

Beach Nourishment

- Beach nourishment is regulated by the USACE's Lake Michigan Regional General Permit (which is the lead agency on these). Permit applications are provided to the IDNR (Coastal Management Program and Office of Water Resources) as well as IEPA. It is generally recommended to prepare the Joint Permit Application.

- Permit approval requires approximately 3-6 months to secure. The length of permit can be requested in the application.

- Emergency nourishment following a storm or wave event is permitted differently than nourishment as part of a beach management. When nourishment is needed because of a storm or wave event that threatens the beach or bluff the Park District can place nourishment immediately. However, a full permit application for the nourishment placement will have to prepared after the fact. Emergency placement of nourishment is not a guarantee the permit will be approved by the governing agencies. If the permit is denied, the improvements would need to be removed at the cost to the park district.

- Unless the intent is to place nourishment immediately, it is not considered an emergency. One cannot secure a permit for nourishment and hold onto it until they need nourishment.

  Beach nourishment should be evaluated on a beach-by-beach basis. It is believe that more beach will be exposed at all of the PDHP beaches as Lake Water levels recede. Nourishment may be used tto protect beaches and bluffs but is expected to be erode while lake levels remain high.

- A joint permit application can cost between $2,800- $3,000 (USD, 2021). In addition, there are permit application fees of $350 or 1% of the project costs, whichever is greater.

- Nourishment is typically placed at between $28-30 cubic yard (USD, 2021), not including contractor mobilization.

6.0 IMPLEMENTATION

Implementation of the recommendations proposed in this plan will require partnerships, community buy-in, cross-departmental collaboration, and dedicated staff. Although some of the recommendations can be conducted without regulatory authorization or permitting, other recommendations such as beach nourishment require regulatory authorization.

Some of the recommendations proposed require Park District scheduling and allocation or distribution of maintenance or budgetary resources. Other recommendations will require additional funding support. And finally, some recommendations can be implemented right away, whereas other recommendations will require phasing and planning to raise funding and secure regulatory approval.

The following outlines recommended next steps for execution of the recommendations in this plan, including the identification of possible funding opportunities and project partners.

POTENTIAL PARTNERSHIPS

Making time to regularly meet with and maintain relationships with partners can be very beneficial. During regular meetings ideas are shared, specific situations or on-site problems can be solved jointly, and trust is built.

Continued participation in the activities of the Illinois Coastal Management Program, including the Shoreline Management Working Group which includes members of regulatory agencies, as well as other public stakeholders, is strongly recommended. In addition, we recommended maintaining a close relationship with the regulatory authorities that have jurisdictional governorship at the beaches. Maintaining close relationships and partnering with these agencies often results in a smoother permitting process.

PDHP should continue to build partnerships with other adjacent beach owners/managers. Opportunities to explore joint projects or even regular sit-downs and ideation sharing can benefit all the beach owners/managers on the great lakes. Possible partners include:

- Openlands
- Wilmette Park District
- Glencoe Park District

IDNR

- Habitat Management
- Sand Management
- Recreational Access and Management
- Development of Protective Structures

USACOE

- Habitat Management
- Development of Protective Structures

IEPA

- Habitat Management
- Sand Management
- Development of Protective Structures
- Stormwater Control

FUNDING STRATEGIES

Several mechanisms are available for funding projects and recommended actions in this plan. Generally, funding can be categorized as:

- State and Federal Grants;
- Private Funding Sources;
- User fees; and
- Expanded partnerships with other units of government.

State & Federal Grants

Although few state grants exist for the execution of beach stabilization or the development of protective structures, state funding is available for the protection, preservation, and restoration of appropriate ecological or cultural resources, controlling and preventing non-point source pollution, and access at the beaches.

The Federal Great Lakes Restoration Initiative funding is channeled through several existing programs, including the Army Corps GLFER fund, for ecological and habitat restoration projects that align with agencies goals and objectives.

The IDNR's Coastal Management Program provides grants at a 1:1 match for projects ranging from $1,000 to $100,000 for the completion of projects over 18 months. This is a cost-reimbursement grant.

The IL Recreational Grants-in-Aide Programs funds capital improvements to create or enhance trails and bikeways. This is a cost-reimbursement program.

The Illinois Transportation Enhancement Program can be used for the development of bike and pedestrian facilities. Applicants can apply for projects up to $2M. This is a matching grant, although the grant match amount varies and matching funds can be from other sources including, depending on the type of work, other granting sources.

The Illinois Environmental Protection Agency officers grant to protect against and control nonpoint source pollution. This funding can be used for developing watershed management plans and education programs and the execution of best management practices for reducing NPS and monitoring NPS systems. This is a reimbursement grant up to 60% of the project cost. The program period is two years but can be available for extension.

The US Environmental Protection Agency's Beach Grants provide aid for the development of water quality monitoring programs and programs for notifying users of beach safety.

The National Fish and Wildlife Fund is soliciting grant requests for the Sustain Our Great Lakes program, directed at projects that will improve and enhance Great Lakes' shorelines.

The U.S. National Park Service offers the Land and Water Conservation Fund. Some work at the beaches may be suitable for the fund under this program.

Private Funding Sources
The Illinois Association of Park District maintains a list of possible grant sources that includes private corporations and foundations. The list identifies several foundations focused on funding various types of public infrastructure or recreational programs.

It is not unreasonable for the Park District of Highland Park to engage appropriate, supporting individuals who may be interested in participating and supporting the funding or matching the funds from a grant program. Or those who may be willing to fund a project with the Park District on their own. Raising private funds requires a dedicated person or team willing to make in-roads with the right businesses or individuals in the City of Highland Park, identify their interests, and align their interests with the needs at the beaches.

User Fees
User fees and access passes should be evaluated regularly. While this model may not fit the Park District in every instance today, it might become a viable model at a later time. Currently, access to beaches is free for residents of Highland Park although vehicular access and parking are limited and require parking passes.

Partnerships with other Units of Government
There may be opportunities to access other funds or promote alternative experiences at the beaches by partnering with other units of local or nearby governments. The Park District could jointly pursue project funding and monitoring dollars with a neighboring park district or beach owner/manager. The Park District could explore joint funding improvements to some existing infrastructure at the beaches, such as the stormwater outfalls.

The Park District is a partner in the Lake County Stormwater Management Commission's effort to develop a Watershed-Based Plan for the Lake Michigan Watershed. Projects that improve water quality and are identified in watershed-based plans can be eligible for grant funding through the Clean Water Act and Great Lakes Restoration Initiative.

NEXT STEPS

Recommended actions for each lakefront property are outlined earlier, including recommendations for routine maintenance and on-going protection and preservation at all the beaches. The following describes the recommended prioritized next steps across all the beaches.

Bluff Monitoring
Bluff monitoring, paired with a bluff stability plan, should be prioritized for Millard beach. This beach appears to be at greater risk than the other PDHP public beaches because the bluff is so close to the shoreline during high lake water condtions. The monitoring should identify when bluff erosion or toe impacts require immediate action or access closure.

A geotechnical evaluation of bluffs is recommended where the bluffs are exposed to heavy toe attack, where vegetation exceeds bluff carrying capacity, and where the top of bluff stormwater runoff threatens bluff stability.

The geotechnical evaluation may include borings to evaluate the rock condition at the bluff. A complete geotechnical evaluation with borings, recommended protection or improvements, an outline of expected permitting, and an engineer's estimate of expected permitting and construction costs could range between $18,000 and $26,000 (USD, 2021 estimate). Fee varies with the expected number of borings, length of the bluff and access to the bluff.

Bluff monitoring is recommended at Moraine, Millard, and Rosewood beaches. It is currently most urgent at Millard. Because of the recent bluff failure at Millard, a geotechnical evaluation of the bluffs at this beach is strongly recommended.

Protecting Existing Infrastructure
Planning for the protection of existing infrastructure at Park Avenue Boating Facility should be developed as soon as funding and resources can allow. Planning is expected to include an engineer's evaluation of the conditions at the site and will require data collection and modeling. Installation of protection measures may require permitting, especially if it is found that protection is needed within the OHWM at the beaches.

Revetement armoring recommendations recommended in the sections for these beaches should be developed to prevent underminging or additional damage of exisiting structures.

Establish a Plan for On-Going Water Quality Monitoring
Identify a plan for on-going water quality monitoring, particularly at Rosewood, if funding is diminished or no longer available.

Groin Repair/Replacement Plan
Establish annual evaluations of the groins at Moraine, Park Ave, and Millard beaches. Conduct the planning and evaluation needed to determine the anticipated, groin replacement or repair allowed by the regulatory agencies.

Groins at all the beaches were identified as older. The USACOE indicated they generally will not permit groins any longer. Alternative forms of structures will be needed if these groins cannot be replaced. The groins at Moraine, Park Ave, and Millard beaches protect the beaches from sand loss. If the groins were to fail, it could have serious negative consequences on the beaches, particularly during periods of high lake water levels.

Nourishment Budgeting & Planning
A budget and plan for on-going nourishment at Rosewood beach should be developed. This is especially important during periods of high lake water levels. As the flagship public beach in the PDHP portfolio, having a plan and understanding of the expected processes and costs for nourshment will provide for swift action and execution of the plan, including submittals to regulatory agencies when needed, with little time loss of public use.

7.0 APPENDIX

Definitions of Terms

Backshore – The part of the shoreline lying between the foreshore and the inland. The backshore is generally dry under normal circumstances and is generally without vegetation. The backshore is only exposed to waves under extreme events with high water levels and storm surge.

Bathymetry – A measurement of depths in a body of water (ocean, lake, pond) resulting in mapping of the lakebed with respect to a given survey datum.

Beach – The zone of unconsolidated material that extends from the offshore line to the place where this is a marked change in material, landform (such as a bluff or dune), or to the line of permanent vegetation. Comprises of both the foreshore and backshore.

Bluff – Landform characterized by a broad, rounded cliff with a steep sloping face. Can be comprised of consolidated and unconsolidated materials.

Breaker Zone – The portion of the shoreline where approaching waves begin breaking. That portion of the shoreface exposed to depth-limited breaking waves. Also called surf zone.

Chart Datum – A low-water surface selected so that water level will seldom fall below it. It represents the still water level which is exceeded 95% of the time.

Cross-shore Transport – The means by which sand moves perpendicularly to the shoreline.

Foreshore – Zone between the offshore and the backshore which is wet due to varying water levels and wave runup under normal circumstances.

Inland – Land that extends landward of the backshore which is not influenced by coastal processes.

Longshore Transport - The means by which sand moves parallel to the shoreline.

Offshore – The zone lakeward of the foreshore. The offshore is generally wet under normal circumstances. This zone includes the 'nearshore zone' where nearshore processes occur, such as depth-limited wave breaking, which drive littoral transport.

Percent Annual Flood Chance – A FEMA defined likely occurance of flooding during a storm event based on water surface levels, site grading and elevation, and frequency of flooding within a given location.

Sediment Transport – The movement of sediment by wind, waves, or current. Includes bedload (sediment rolling along the lakebed), suspended (sediment lifted into the water column), and aeolian (sediment carried by the wind).

Stillwater – The water elevation at a shoreline absent the effects of wave actions.

Topography – Mapping of the land with respect to a given survey datum.

Wave Overtop – The volume of water from waves that break or pass over shore barriers and beaches. Overtopping can occur as a continuous flow, as splash, and as spray.

Wave Runup – The uprush of water above the Stillwater elevation caused by wave action at a beach or shore barrier.

Wave Setup – The increase in water level above the stillwater elevation.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NATURAL
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COASTAL
Management Program
IL Dept of Natural Resources
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