

## Kemper Center Shoreline Protection Design Case Study

*Title of Project:* Kemper Center Shoreline Protection Phase III

*Organization:* Kenosha County Division of Parks

*Total project cost:* \$61,480

*Grant award:* \$30,000

*Summary:* Kenosha County wanted to protect the shoreline at the Kemper Center from ongoing erosion and flooding damage while maintaining public access so that the grounds can continue to serve as a community gathering space, recreation area and shared-use thoroughfare along Lake Michigan. The overall effort to redesign the Kemper Center shore protection was a phased initiative that leveraged multiple funding sources to work with consultants over three years to design concepts for a shoreline revetment and cobble beach as well as improved stormwater management and site grading to better deal with flooding. The current Phase III includes stormwater management and site grading plans, site investigation of reusable material existing on-site and coordination with regulatory agencies. The county is now pursuing funding to construct their shovel-ready design that has been engineered for resiliency to Lake Michigan water levels and waves.



Panoramic view of the Kemper Center and shoreline. [Source: 2020 Google Earth image]

This project was part of the larger [Southeastern Wisconsin Coastal Resilience project](#) (link) which provided funding to Lake Michigan coastal local governments in Kenosha, Racine, Milwaukee, and Ozaukee counties to address priority coastal hazard issues identified in a [Coastal Resilience Self-Assessment](#). This project was funded by the Wisconsin Coastal Management Program and the National Oceanic and Atmospheric Administration, Office for Coastal Management, Grant # NA17NOS4730144



## **Coastal Resilience Self-Assessment Summary**

*Kenosha County's completed Coastal Resilience Self-Assessment highlighted priority needs to rehabilitate shoreline protection structures that protect coastal assets and ensure that shore protection structures are routinely inspected and maintained to ensure long-term function.*

Kenosha County completed a two part [Coastal Resilience Self-Assessment](#) ([link](#)) to help prioritize top coastal hazard concerns (Part 1) and identify potential planning and mitigation practices to address these hazards (Part 2). Below are some highlights from Kenosha County's self-assessment that guided the development of this project.

Part 1: Identifying Coastal Hazard Risks - A matrix tool to prioritize potential coastal hazard issues based on rating each hazard on frequency of occurrence, impact to the community and level of preparedness.

The top hazard of concern identified in matrix tool was a tie between Shoreline Recession/Bluff Failure and Shore Protection Damage. Both hazards were perceived to have a high probability of occurrence, moderate-to-high impacts on the community, and low-to-moderate levels of preparedness, leading these to both be deemed high priority coastal hazards to address.

Part 2: Resilient Practices Questionnaire - A series of 40 yes/no questions about potential opportunities for communities to strengthen their approach to coastal hazards, including planning, zoning, education, and constructed actions. The following questions led Kenosha County to consider some actions to enhance their resilience to coastal hazards.

*Question 8:* Have the strategies from the local Hazard Mitigation Plan been implemented?

The Kenosha County Hazard Mitigation Plan (2017-2020) lays out priority mitigation measures that deal with Lake Michigan Coastal Hazards on page 230. The priority measure "Continue construction and maintenance of shoreline protection structures to protect urban development in selected areas of the County" was deemed a top initiative due to ongoing flooding and erosion issues with the only County-owned property, the Kemper Center.

*Question 25:* Is inspection and maintenance of shore protection structures performed routinely?

A degraded revetment at the Kemper Center was no longer providing adequate protection to the grounds. Kenosha County Parks also recognized that any efforts to rebuild shore protection required a long-term maintenance plan that allocates costs to ensure longevity of the structure.

*Question 27:* Does your community consider hybrid-structural options (nature-based or engineering with nature approaches) or nonstructural options?

Shore protection structures like revetments can reduce habitat and restrict public access. The conceptual designs for shore protection at the Kemper Center considered a hybrid-structural approach that included a cobble beach that would provide public access to Lake Michigan while also maintaining protection from erosion and flooding.

## **The Coastal Resilience Issue**

*The grounds of the Kemper Center, a cultural and recreational facility which is the only Lake Michigan coastal property owned by Kenosha County, has been routinely damaged by a combination of coastal storms and high Lake Michigan water levels.*

The Kemper Center is a cultural and recreational facility located along approximately 1,450 feet of shoreline on Lake Michigan. This parcel is the only property along the lake owned by the County. The 15-acre property is home to historic landmarks (circa 1800), floral landscaping, along with a scenic setting overlooking Lake Michigan. Frequently the site of lawn concerts, art exhibits, retreats and weddings, the grounds of the Kemper Center also offers a bike and pedestrian path along the lake, picnic areas and a soccer field.

The shoreline of the Kemper Center currently consists of a degraded stone revetment that no longer provides an adequate level of protection from the combination of coastal storms and lake level fluctuations that are routine on this stretch of Lake Michigan. The revetment, bike path, and park grounds were damaged during major storm events in 2015, 2016, and 2020. The January 2020 storm caused enough damage across Kenosha, Racine and Milwaukee Counties to qualify for a FEMA Major Disaster Declaration (DR-4477). Wave overtopping during these storms has displaced significant amounts of revetment material landward onto the lawn, path and parking lot, requiring removal with heavy equipment. In the January 2020 storm, it is estimated that almost 3000 tons of stone were displaced an average of 41 feet landward. Waves overtopping the revetment have also caused localized flooding on the path and surrounding landscape. With every large storm, the revetment continues to degrade through the displacement of armor stone and subsequent lowering of the crest elevation. This leaves the Kemper Center and its grounds increasingly vulnerable to coastal erosion and flooding.



Kemper Center shoreline before (left) and after (right) the January 10-12<sup>th</sup>, 2020 storm [photo by Kenosha County]

## **Vision for the Community**

*Kenosha County wants to protect the shoreline at the Kemper Center from ongoing erosion and flooding damage so that the grounds can continue to serve as a community gathering space, recreation area and shared-use thoroughfare along Lake Michigan.*

## **The Need**

*There is a need to develop sustainable strategies to adequately protect the shoreline that still maintains public access to the Kemper Center shoreline.*

Specifically, these strategies for shoreline protection include:

- Rehabilitate the degraded shoreline revetment to provide adequate protection to expected storms and lake level fluctuations
- Extend or relocate stormwater outfalls to avoid conflicts with public access and minimize the risk of debris buildup and damage by wave and ice action.
- Regrade the site to preserve the use of activity spaces in the park while directing stormwater and any overtopping floodwaters to stormwater management areas that can mitigate point water discharges.

## **Collaborators**

- Kenosha County Division of Parks
- Kenosha County Emergency Management Department
- The City of Kenosha
- Kemper Center, Inc
- Consultant Engineering Firms
- United States Army Corps of Engineers
- Wisconsin Department of Natural Resources
- FEMA

## **What was accomplished**

*The overall effort to redesign the Kemper Center shore protection was a three-phase initiative, with the current Phase III including stormwater management and site grading plans, site investigation of reusable material existing on-site and coordination with regulatory agencies.*

### A phased approach – making design progress while leveraging funding

Kenosha County started working on designs and specifications for a shoreline protection project in 2017. Kenosha County worked with engineering consultants to complete this work in multiple phases determine the best design as informed by site investigations and studies while also leveraging available funding opportunities.

Phase I started with a coastal engineering study to develop conceptual strategies in order to improve public access to the Kemper Center shoreline. This phase was funded by Kenosha County.

Phase II began the coastal engineering design of the preferred shore protection alternative, funded in part with a \$48,592 grant from the Wisconsin Coastal Management Program, with \$72,888 in match provided by Kenosha County. This led to the design of a revetment that features a cobble beach for public access. The revetment was designed following U.S. Army Corps of Engineers Great Lakes design practices to

withstand a combination of 20-year return period water levels and storm surge (i.e. a 5% chance of occurring in a year) and 10-year return period wave conditions (i.e. a 10% chance of occurring in a year).

Phase III is the current project which focuses on three goals: (1) conduct a thorough analysis and design of stormwater management and site grading plans, (2) conduct a site investigation to assess the current salvageable material at the Kemper Center shoreline site, (3) work towards regulatory coordination of the project. Kenosha County was awarded \$30,000 by the Coastal Resilience Grant Program which matched was matched with \$30,000 from Kenosha County Parks.

#### Goal 1 - Design a Stormwater Management and Site Grading Plan

A consultant engineering firm completed storm sewer and site grading designs for the shoreline area. In particular, two stormwater outfalls were designed to be rerouted for better site drainage and to relocate outfall discharge away from the area of the proposed cobble beach. The site regrading also directs runoff into swales for improved drainage if the revetment is overtopped. These details were incorporated into the overall design documents, plans, and specifications and permit applications.

#### Goal 2 - Site Investigations

Site investigations analyzed and cataloged the entire shoreline and existing revetment materials to determine the quantity of material such as granite armor stone that could be salvaged for reuse in the final shore protection design. The subsoil conditions near the shoreline were also investigated with exploratory test pits. The investigation revealed the presence of some foundry waste material. Kenosha County is currently working with environmental consultants to further examine the waste discovered in order to determine best practices for disposal.

#### Goal 3 - Regulatory Coordination

One of the most important goals of this project was to further the regulatory coordination for the project. Based on the design work, permits were prepared and submitted to the appropriate regulatory agencies (U.S. Army Corps of Engineers and Wisconsin DNR) for feedback and comments. By coordinating early with regulatory agencies, any issues with the designs will hopefully be resolved early in the process.

#### **Partnerships Reinforced or Made**

After the January 2020 storm damage, Kenosha County Parks met with coastal engineers, Wisconsin state officials, and FEMA representatives on site of the Kemper Center shoreline to show and assess damage left in wake of the January winter storm event. This was a preliminary measure to determine damage estimates in an effort to secure federal aid in repairing damage to public infrastructure. Kenosha County has continued to collaborate with FEMA and anticipates submitting a request for financial assistance through the public assistance program to replace 549' of multiuse trails and to remove, dispose, and repair approximately 412' of shoreline (2,968 tons).

### **Future Prospective**

With the shoreline protection and site designs already in-hand, Kenosha County submitted a request for Public Assistance in order to repair the shoreline as part of FEMA Major Disaster Declaration DR-4477. In addition to repairs, Kenosha County will also seek support for long-term sustainable management and repairs of the Kemper Center shoreline that will reduce the impact of damage in the strong storms and high lake levels inevitably occur again.

### **Lessons Learned**

- Using a phased approach helped move the project forward by keeping it manageable and allowed various funding opportunities to be leveraged as they arose.
- Addressing stormwater management concurrent with the shore protection design allowed for the two systems to work better together to reduce flooding and damage to the stormwater infrastructure.
- When the January 2020 coastal storm struck, the site surveys, inventories, and investigation results helped to quickly quantify the damage.
- The preparation of design documents for construction of the shoreline rehabilitation positions the project to be shovel-ready for seeking implementation funding.

**Additional Photos [all images provided by Kenosha County]**

**Before January 2020 storm**



**After January 2020 storm**

