CHAPTER 9

PROJECT PROFILES

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What's in this chapter?

Proposed Projects

A total of 21 projects (see list at right) are recommended to improve resiliency throughout Monroe County and the CLEAR communities. These projects range from policy recommendations to natural systems protection to infrastructure improvements. Several are regional in nature, while others are site specific. Each is designed to help achieve the community vision and goals and address identified needs.

Project Profiles

The project profiles on the following pages provide in-depth descriptions of each project including benefits, process of implementation, estimated cost, and potential funding sources. These profiles are intended to be used by municipalities to build community and political support and awareness, and as supporting documentation for grant applications.

Project Selection Criteria

Projects were considered for inclusion in the CLEAR Plan based on their cohesion with the following criteria:

1. Anticipated resiliency benefit over the long-term and risks and needs addressed by the project
2. Potential resilience created relative to high-water, low-water, and fluctuating water level scenarios
3. Community support for the project and willingness from potential project partners
4. Potential community benefits including broader resilience and economic development
5. Potential availability of financial resources (local, state, federal, private, non-profit) to implement the project
6. Connection to community vision, goals, and strategies

Project Implementation Process

Project sponsors and partners who are interested in carrying the proposed projects forward are encouraged to do so and can seek funding from the sources listed and technical guidance from DOS, DEC, New York SeaGrant, Cornell Cooperative Extension of Monroe County, and other identified partners.

Details of the project profiles, including project scale, scope, cost, and timeframe, may change with climatic, lake, and community needs but, as they exist today, they are intended to provide a conceptual starting point for project sponsors to consider. Prior to project kick-off, an inventory and assessment of current efforts, like REDI projects in the region, should be conducted so that new activities can enhance and complement those efforts and identify any existing gaps as well. Several proposed projects may also benefit from regional and inter-municipal coordination.

Proposed Projects

Community Planning Projects

1. Local Laws to Increase Resiliency
2. Shoreline Data Needs Planning Study
3. FlushMap + FlowMap Online Visualization Tools

Health + Social Services Projects

4. Emergency Services + Critical Infrastructure Study for Monroe County

Infrastructure Projects

5. Porous Pavement
6. Shoreline Protection in Greece + Irondequoit
7. Near-Shore Wave Energy Attenuation System

Economic Recovery Projects

8. Lakeshore Business Retention + Resiliency Program
9. Cost-Conscious Communities Program
10. Fiscal Impact Analysis for Shoreline Municipalities

Housing Projects

11. Mitigate Vulnerable Structures in Irondequoit
12. Regional Buyout Lease-Back Housing Program

Natural + Cultural Resources Projects

13. Coastal Bluff + Beach Protection
14. Regional Modeling in the Rochester Embayment
15. DEC Fishing Access Elevation + Enhancements at St. Paul Terminus
16. Durand Eastman Beach Resiliency + Access Plan
17. Ellison Park Resiliency Master Plan
18. Genesee Riverway Trail Green Infrastructure Program
19. Hamlin Beach State Park Resiliency Master Plan
20. Salmon Creek Park Pilot Project
21. Turning Point Park Master Plan + Boat Launch

Basic Info

Location: Countywide

Site owner: Applicable municipality

Jurisdiction: Applicable municipality

Potential sponsors: Applicable municipality

Resiliency Area

Community Planning + Capacity

Related Goals

- Safe + Healthy Communities

Complementary Projects

- 11 Mitigate Vulnerable Structures in Irondequoit
- 12 Regional Buyout Lease-Back Housing Program

Project #1

Local Laws to Increase Resiliency

Project Description

A local laws assessment helps local governments understand which local laws and ordinances could be updated in order to increase community resilience to climate impacts like fluctuating lake levels, wave action, erosion, and flooding.

Demonstrated Need

Monroe County residents, especially those who live along the Lake Ontario shoreline, are at increased risk to extreme-weather events and fluctuating water levels as the effects of climate change become more frequent and more intense into the future. While CLEAR municipalities have a variety of existing local laws and ordinances, updating these policies or implementing new policies can help communities be more resilient and anticipate, prepare for, mitigate, and more quickly recover from climate threats.

Potential Benefits

Updating local laws with considerations for resilience can reduce vulnerability of life and property to the effects of climate change and decrease municipal and private expenditures for clean-up and recovery.

Community Support

Throughout the public engagement process, community members have expressed interest in codifying the recommendations in the CLEAR Plan as local policies and in using these policies to support and complement the proposed structural and programmatic projects.

Local Laws to Increase Resiliency

Resilience Relative to Scenarios

High-water conditions: Local laws can be updated to increase resiliency for high-water scenarios by requiring mitigation strategies for vulnerable structures (including flood-proofing and elevating), by limiting certain types of development in vulnerable areas, and by establishing thresholds of damage that require properties to be brought into compliance with current codes and ordinances. Moratoria and temporary restrictions can preserve the option to work with property owners to determine if rebuilding restrictions are feasible.

Low-water conditions: In extreme low-water conditions, where previously underwater land is reclaimed, local law changes will be necessary to determine how ownership and development regulations should be applied.

Case Study | Coastal Erosion Hazard Areas

NYS DEC's Coastal Erosion Hazard Area (CEHA) Permit Program enables DEC to identify and map coastal erosion hazard areas and to adopt regulations to control certain activities and development in those areas. The construction or placement of a structure, or any action or use of land which materially alters the condition of land, including grading, excavating, dumping, mining, dredging, filling or any disturbance of soil is a regulated activity requiring a Coastal Erosion Management Permit.

Certified CEHA communities administer their own CEHA program at the local level. In Monroe County, Greece, Hamlin, and the City of Rochester are certified CEHA communities. In these municipalities, permits must be submitted to the local building or zoning department and must follow any other requirements set forth in the community's local ordinance. In the other Monroe County coastal communities (Irondequoit, Parma, Penfield, and Webster), permits are submitted to and handled at the State level.

Project #1

Local Laws to Increase Resiliency

Phasing

The following sequence is recommended for implementation:

1. Law is drafted
2. Law is introduced to the local legislative body by one of its members
3. Notice of hearing is published
4. Public hearing is held
   - 4a. If no changes are made to the proposed law, the municipal body moves to adoption (Step 5)
   - 4b. If the proposed law is amended or redrafted based on input from the public hearing, the law must be re-introduced to the legislative body (Step 2) and another public hearing must be held
5. Law goes to a vote for adoption or is approved by the chief executive officer as the case may be

Timeframe

1 to 2 years | **3 to 5 years** | 5+ years

Estimated Cost[1]

Partial update:[2] $10K to $25K
Comprehensive update:[3] $70K to $100K

[1] Estimated costs are per unit.

[2] A partial update includes the creation of a new district or new local law.

[3] A comprehensive update includes the creation of a new district or law in addition to review of and amendments to the municipality's existing code in order to better integrate the new policy into the existing code.

Cost-Benefit Analysis

Local laws for resiliency are designed to reduce the risk of damage from high-water events and thus reduce municipal and private expenditures for recovery and rebuilding.

Potential Funding Sources

- DOS Local Waterfront Revitalization Program
- DOS Smart Growth Comprehensive Planning Grant Program
- DEC Climate Smart Communities Grant Program

Required Permits or Approvals

- SEQRA

Potential Challenges

It is likely that implementing or expanding existing resiliency regulations, including those for waterfront zoning districts or setback regulations, may result in certain areas or properties being deemed uninhabitable. The loss of property tax base as a result must be weighed against reduced municipal expenditures for flood response and mitigation costs in these areas.

Opportunities to Increase Resilience
in CLEAR Municipalities

The table below shows existing policies and gaps in policy for the CLEAR municipalities. Municipalities with existing policies can update these policies to include resilient elements while municipalities without particular policies can consider adopting them. Model ordinances from NYS DOS's "Model Local Laws to Increase Resilience" are recommended for each policy type. (See **Chapter 2, Zoning and Local Laws** for a more in-depth analysis of existing local laws.)

Existing Policy
potential to update with resilient elements

Policy Gap
potential to create new policy

Policy Type Recommended Model Ordinance	**Greece**	**Hamlin**	**Irondequoit**	**Parma**	**Penfield**	**Rochester**	**Webster**
Zoning Districts Basic Land Use Tools for Resiliency, Part A, Section 1-1.2.4	■	■	■	■	■	■	■
Waterfront, Conservation, and/or Environmental Overlay Districts Basic Land Use Tools for Resiliency, Part A, Section 1.1.2	■	■	■	■	■	■	■
Site Plan Review Basic Land Use Tools for Resiliency, Part C, Section 1.6	■	■	■	■	■	■	■
Subdivision Regulations Basic Land Use Tools for Resiliency, Part C, Section 1.5	■	■	■	■	■	■	■
Local Waterfront Consistency Review Law Basic Land Use Tools for Resiliency, Part A, Section 1.1-1.1.3	■	■	■		■	■	■
Flood Damage Prevention Management of Floodplain Development, Parts A and B; Basic Land Use Tools for Resiliency, Part B, Section 1.3-1.4.5	■	■	■	■	■	■	■
Coastal Erosion Hazard Areas Coastal Shoreline Protection Measures, Parts A, B, and C	■	■				■	
Stormwater MS4 Permit Stormwater Control Measures, Parts A and B	■		■	■	■	■	■
Environmental Review Wetland & Watercourse Protection Measures, Parts A and B			■			■	

Basic Info

Location: Lake Ontario shoreline in Monroe County

Site owners: various

Jurisdiction: Monroe County

Potential sponsors: Monroe County

Potential partners: New York SeaGrant

Resiliency Area

Community Planning + Capacity

Related Goals

- Design with Nature

Complementary Projects

- 14 Regional Modeling in the Rochester Embayment
- 6 Shoreline Protection in Greece + Irondequoit
- 7 Near-Shore Wave Energy Attenuation System

Project #2

Shoreline Data Needs Planning Study

Project Description

This study would gather important data relative to shoreline resiliency at public and private shoreline properties within the municipalities bordering Lake Ontario in Monroe County. The end product of the study would be GIS data files that can be used as a planning tool by local municipalities. The databases created would provide current information regarding shoreline conditions following the 2017 and 2019 high-water events, and incorporate finer detail and local knowledge than what is currently available in Lake Ontario shoreline databases.

Demonstrated Need

Accurate and readily available data that represents existing conditions is very important in the community planning process. Existing sources of shoreline conditions are broad-based, and have not been updated since the 2017 and 2019 high lake level flooding events.

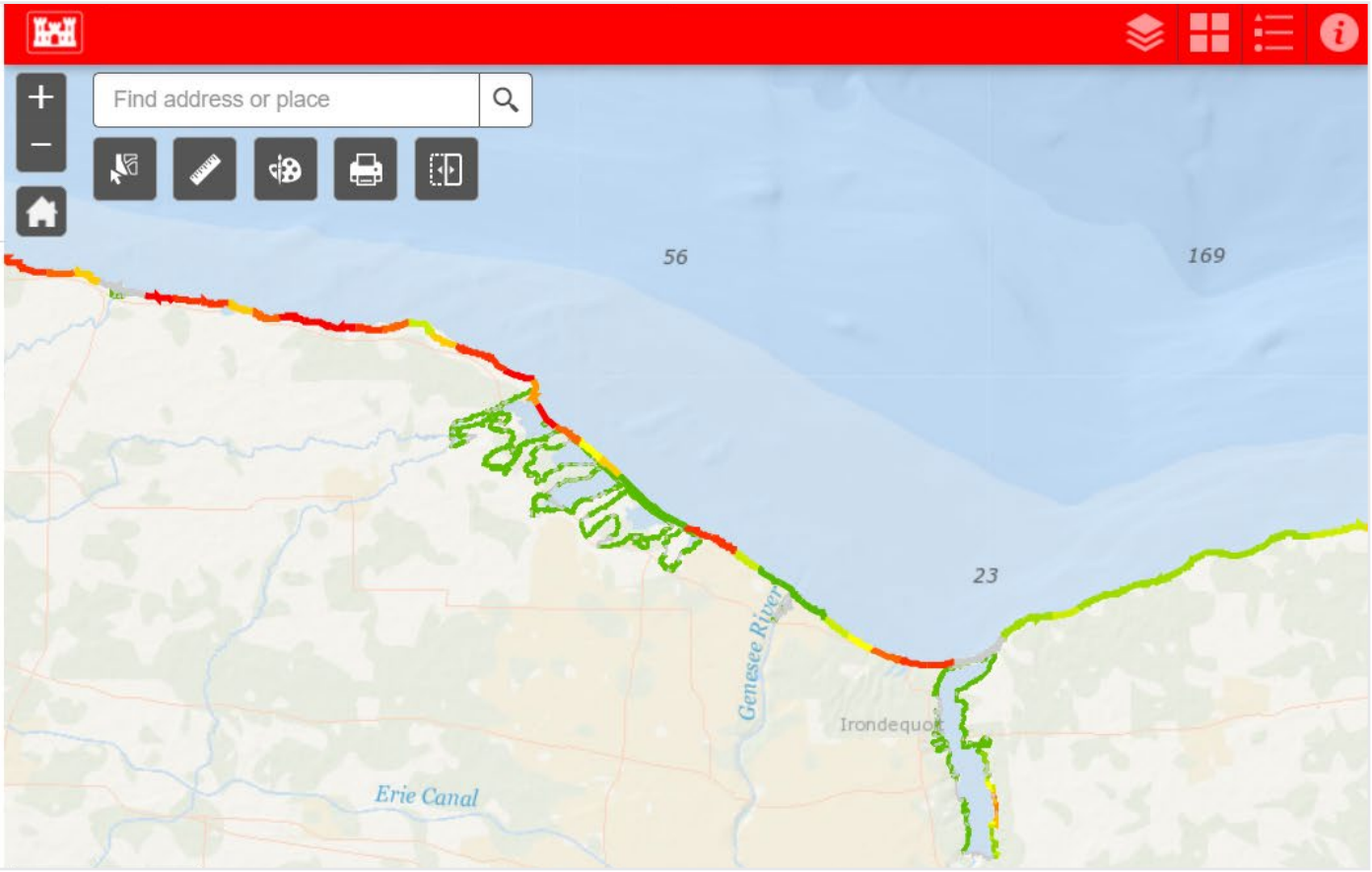
Potential Benefits

The benefits of undertaking this study are many, including a better understanding of the present conditions of sensitive ecosystems along the Lake Ontario shoreline in Monroe County. This increased knowledge will aid decision making related to community planning and local regulations, shoreline protection needs, and community education and awareness. It will also provide another baseline for comparison to future conditions by helping to identify erosion hot-spots and other shoreline changes.

Shoreline Data Needs Planning Study

Assessing Opportunities for Natural and Nature-

Natural and Nature-Based Features (NNBF) are shorelines that are actively developed and/or maintained for both shore protection and ecosystem enhancement. The purpose of this viewer is to help inform landowners, both public and private, whether their property is opportune for a natural or nature-based shoreline.



Project #2

Shoreline Data Needs Planning Study

Community Support

This project can provide data needed to help protect life, health, and property against damage caused by lake level fluctuations. Data collected regarding the nearshore and coastal environment can be used to support conservation and restoration efforts, promote safe community growth, preserve high value areas, and educate the public on environmentally sensitive areas.

Resilience Relative to Scenarios

This project will improve understanding of the diverse conditions along the Lake Ontario shoreline, which will lead to better understanding of the implications of both high-water conditions and low-water conditions.

Implementation

This study would build upon the data that is readily available from existing Lake Ontario shoreline characterization databases developed by others, such as can be found in the U.S. Army Corps of Engineers Natural and Nature Based Feature Opportunities Viewer (e.g. Historical Shoreline Erosion Rates, Shoreline Classification, and Shoreline Structural Measures).

Up-to-date high resolution oblique aerial photography or drone video files would be utilized to assist in developing parcel-based inventory and limits of existing shore-based structural measures (revetments, bulkheads), and their condition with field site visits as needed to document conditions at identified erosion hot-spots. Data would be used to identify and validate threatened shoreline areas where development should be avoided, evaluate needs and potential suitability for shoreline protection projects, and support grant funding applications.

Timeframe

1 to 2 years | 3 to 5 years | 5+ years

Estimated Cost

$50,000 to $100,000

Cost-Benefit Analysis

This data collection will inform the development of many other projects, including the Near-Shore Wave Energy Attenuation System and other projects proposed as part of CLEAR. This upfront cost will result in better and more effective outcomes for the resulting

Shoreline Data Needs Planning Study

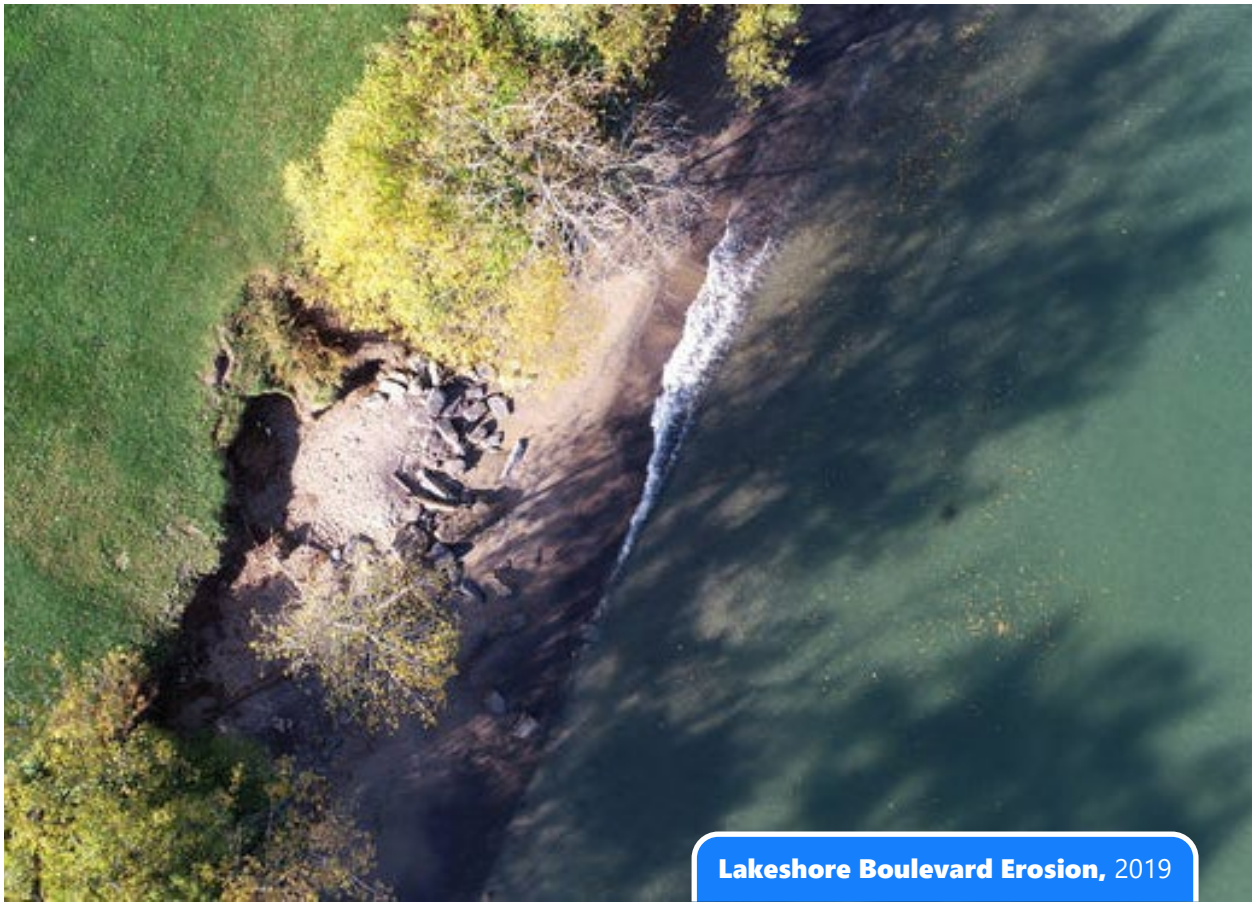
projects, maximizing their potential benefits by ensuring that all the most accurate and up-to-date information is considered in their design.

Potential Funding Sources

Engineering design and feasibility studies are eligible for funding through the Federal Emergency Management Agency (FEMA) Building Resilient Infrastructure and Communities (BRIC) program as a "project scoping" activity. funds. Funding for feasibility studies is also available through a partnership with the USACE.

Required Permits or Approvals

No permits are required to conduct this study.



Lakeshore Boulevard Erosion, 2019

Basic Info

Location: Countywide

Site owners: Not applicable

Jurisdiction: Various

Potential sponsors:
Monroe County

Potential partners:
New York Sea Grant

Resiliency Area

Community Planning + Capacity

Related Goals

- Equitable Ownership

Complementary Projects

1. Local Laws to Increase Resiliency
4. Emergency Services Study for Monroe County

Project #3

FlushMap + FlowMap
Online Visualization Tools

Project Description

The FlushMap and FlowMap tools integrate the locations of storm sewer assets with established FEMA and state and local risk assessments to provide a critical visualization as to where such infrastructure is at the greatest risk, and where public projects are being implemented to address or reduce those risks.

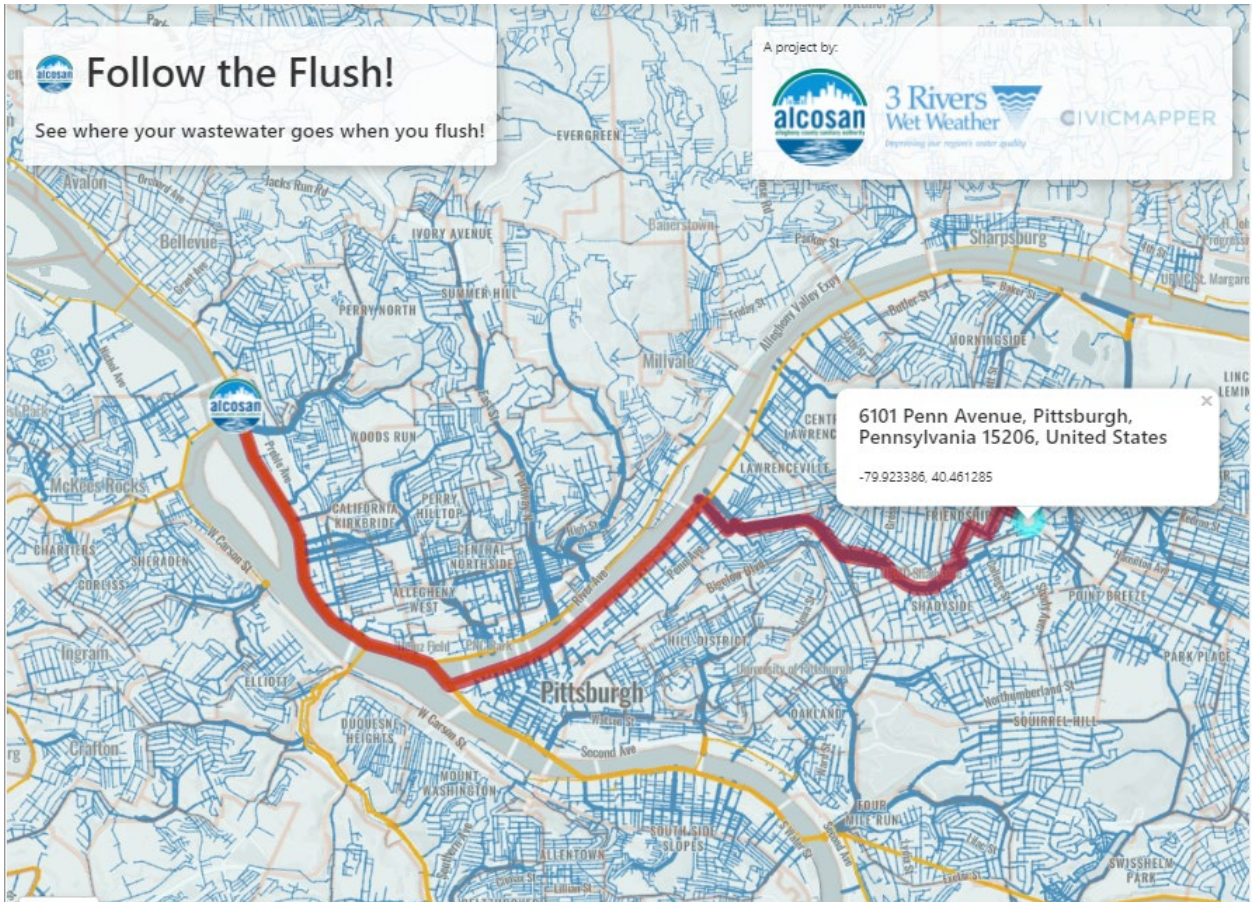
Demonstrated Need

Flooding and the subsequent damage caused to public infrastructure is an ongoing issue not just in the coastal area, but across the region. Flooding has many source causes, including changing lake levels, increases in runoff due to changing landscape conditions, and increases in precipitation during extreme wet weather events.

Much of the sanitary and stormwater infrastructure is hidden underground or similarly out of sight and hence is often out of the realm of public awareness. However, both sanitary and stormwater infrastructure systems can have a significant impact on public health and disrupt the communities they serve during high water or storm events.

For the general public, or even key public officials, the issues surrounding pubic sewer infrastructure are typically just too intangible to really understand until something breaks, or a catastrophic failure occurs. Understanding the vulnerability of these critical assets to risks posed by flooding or climate change has, until now, been the exclusive purview of experts with in-depth technical knowledge and special software tools.

FlushMap + FlowMap
Online Visualization Tools



How it Works

Visualization tools can show where water flows, either in the sanitary or the stormwater system, from its initiation point (e.g., a house or business), all the way to the treatment plant or outfall (e.g., Genesee River, Irondequoit Creek, Lake Ontario, etc.). In many cases, water will pass through critical infrastructure like a pump station or a combined sewer line that is in a flood risk zone, or it may travel along a long gravity main that is prone to leaks and infiltration. Along any route, key infrastructure, risk zones, and flood levels can be highlighted.

The tools would be accessed directly from a webpage and would demonstrate where key projects are being implemented through programs like REDI. The resulting map would show where parts of the traced path may be exposed to risk from high water events or flood zones, and why certain areas are being fixed to reduce their vulnerability.

Project #3

FlushMap + FlowMap
Online Visualization Tools

Demonstrated Need CONTINUED

The FlushMap tools offer accessibility into this complex domain through the use of modern, web-based mapping technology that anyone can use.

Projects like this will help to educate and inform those communities on how much of their infrastructure is at risk, what is being done now, and what more can still be done about it. While it is important to highlight risks and the potential strategies for mitigating that risk, it is equally important to highlight successes where forward thinking public projects have sought to reduce risks and improve community resiliency.

Potential Benefits

A set of web-based data visualization tools will not directly reduce infrastructure risk or improve community resiliency. It can, however, help improve community engagement and knowledge on key public health and infrastructure issues and help change how members of the public understand the relationship between existing infrastructure and the risks posed to that infrastructure. Helping people understand where the risks are and how our tax dollars are being used to reduce those risks is a significant step in gaining community support on key issues, particularly when they are not flashy and visibly appealing, like a new park or public space. Communicating this information is also essential for helping the public understand what is at stake if nothing is done, and what positive actions can still be taken.

Community Support

Public education and awareness are important aspects of building community-based support for projects intended to improve lives and protect property. Providing relevant information to non-technical people in an accessible and engaging format that communicates the issues directly is what the FlushMap tools are designed to achieve.

Resilience Relative to Scenarios

This project is not impacted by changing water levels (high or low lake levels). It is possible to integrate near-real time monitoring information and visualization data (weather updates, gage readings, camera feeds, etc.) into the toolset to allow a viewer to understand how a current event might relate to current risk, and offer the ability to view such events within the framework of the ongoing long-term risk assessment.

Timeframe

1 to 2 years | 3 to 5 years | 5+ years

FlushMap + FlowMap
Online Visualization Tools

Implementation

The following phases are recommended for implementation:

1. System architecture and functionality is designed.
2. Tool is launched.
3. Development of community outreach plan and content creation.
4. Implement community outreach.

Additional phases could be added based on the success of the initial roll-out:

5. Expand efforts to integrate data with neighborhood municipalities.
6. Expand functionality, content, and outreach delivery.

Estimated Cost

$50,000

Cost-Benefit Analysis

This project may be viewed as part of ongoing costs associated with community outreach and education. MS4 regulated municipalities have outreach and education requirements. This kind of project is very low cost when compared to more traditional "brick and mortar" style flood mitigation projects. It can also reach a relatively large number of people when compared to other types of projects.

Potential Funding Sources

- Great Lakes Protection Fund
- Community MS4 Compliance

Required Permits or Approvals

Not applicable.

Increasing Access to Information

The FlushMap tools increase equitable access to information and help answer questions like:

What happens if lake levels rise?

When it rains, where does all the water go?

What happens if parts of the sewer system fail because of flooding?

What is being done to keep our shorelines clean and safe?

Potential Challenges

Few challenges are expected for implementation as Monroe County has a wealth of readily available high-quality geographic information system (GIS) data and local municipalities who are willing to share theirs. Encouraging community use of the tools may be the greatest constraint to success. Training for local municipalities should be incorporated to increase use.

Basic Info

Location: Countwide

Site owners: Various

Jurisdiction: Various

Potential sponsors:
Monroe County, GTC

Resiliency Area

Health + Social Services

Related Goals

Safe + Healthy Communities

Complementary Projects

2 Shoreline Data Needs Planning Study

REDI Bay Outlet Swing Bridge, Lake Rd (West End), St. Paul Terminus, Edgemere Dr/Island Cottage, Edgemere Dr/Cranberry Rd, Shoreline Roads/Storm Sewers, Culver Rd Storm Sewers

Project #4

Emergency Services + Critical Infrastructure Study

Project Description

This project proposes a planning study with a specific focus on further evaluating risk and vulnerability of Monroe County emergency facilities and transportation infrastructure located within the NYS DOS High and Extreme Risk Areas. These facilities are critical for providing emergency response support during high Lake Ontario level events. In addition to these physical assets, the study could include assessment of emergency operations, County evacuation plans, and temporary shelter locations.

Demonstrated Need

Transportation infrastructure and emergency response facilities within the NYS DOS Lake Ontario Risk Areas are known to be vulnerable to high Lake Ontario levels which have occurred in recent years. Existing planning studies prepared by the Genesee Transportation Council (GTC) have studied local bridges at a broad seven-county regional level. A more local study of areas directly affected by the Lake Ontario high lake levels in Monroe County is needed to support application for federal transportation funding and other applicable grants. This particlar project will generate the scope and estimated project costs for mitigation that will reduce risk and increase the resiliency of these important facilities, and provide a cost basis for funding and implementation.

Potential Benefits

The potential benefit of this study will be formal documentation of the challenges and impacts that Lake Ontario extreme flood events have on the aspects of emergency response operations and the facilities that support these vital activities in Monroe County. This report

Emergency Services + Critical Infrastructure Study

Emergency Facilities | Lake Shore Fire Department

A site visit and meeting was held with Chief Jay France of the Lake Shore Fire District at 1 Long Pond Road in the Town of Greece during the preparation of this project profile. During the high Lake Ontario levels experienced in 2017 and 2019, flood waters surrounded the parking lot and Fire Department building for months. Since that time the building has shown evidence of settlement, including cracks in walls and floors, door frames out of true, and broken settled concrete slabs in the garage bays and driveway. While the flooding never reached the building envelope, the effects of saturated ground has had a lasting adverse impact to the Lake Shore Fire Department station.

Critical Infrastructure | North Hamlin Road Bridge

The North Hamlin Rd. bridge over Sandy Creek (BIN 3317640) was identified by the Monroe County Highway Superintendent as a bridge that has experienced impact from natural or human influenced factors and was studied by the engineers who prepared the study. This is an example of a bridge – based on local knowledge and historic experience – that may rank as having greater importance when compared to other bridges in the Lake Ontario Risk Area.

Project #4

Emergency Services + Critical Infrastructure Study

will serve as a valuable tool for gathering insight from emergency responders, and generating public awareness of the challenges. A formal report will be used to support funding for enhancing operations, and for mitigation projects that can support infrastructure including equipment and facilities that support emergency response operations.

Community Support

Uninterrupted access to emergency services and critical infrastructure, especially during high-water or other storm events, is important to the preservation of life and property. As such, community support is expected to be high for a project like this.

Resilience Relative to Scenarios

This project will promote identification of mitigation projects aimed at reducing risk and vulnerability to infrastructure and emergency response facilities and operations resulting from high Lake Ontario level events. Low water levels are not anticipated to be detrimental to these features, but the mitigation projects that are derived from this study will provide resiliency benefits by making sure emergency response will not be prevented or delayed by high-water conditions.

Timeframe

1 to 2 years | 3 to 5 years | 5+ years

Implementation

This study would be patterned after and draw upon similar data used in developing important existing related planning studies, such as the Monroe County Hazard Mitigation Plan and relevant GTC studies, as well as input from the county, local facility operating officials, and first responders.

The study would make use of readily available data on bridges (including bridge inventory records of structure and foundation type, existing scour vulnerability, condition inspection reports, etc.), culverts, and roadways (geometry or elevation, system importance) and engineering analysis and experience to evaluate vulnerability of these facilities to damage or interruption in service resulting from high Lake Ontario levels.

A system would be developed as part of this study to quantify and rank the importance of these infrastructure features within the context of the DOS Lake Ontario Risk Areas. Those features that rank highest would be investigated further, with some field visits, a mitigation plan, and cost

Emergency Services + Critical Infrastructure Study

estimates prepared for recommended implementation. Examples of the types of mitigation proposed could include culvert replacement, bridge replacement or improvement, elevating roadways, stabilizing roadway sideslopes and installation of erosion protection, and pavement reconstruction, etc.

Potential critical facilities to consider may include the Lakeshore Fire district-Long Pond Road Firehouse, Monroe County Sheriff Parks Unit, Monroe County Marine Unit, Union Hill Fire Department, and the US Coast Guard Auxiliary among others. Other complementary projects that could be considered are those facilities and services that enable these emergency services, including infrastructure projects like gas and electric facilities, water supply, transportation equipment, communications equipment, and medical facilities.

A report of the study would include recommended mitigation projects to increase resiliency at the highest ranking vulnerable infrastructure and emergency response facilities. The completed study would provide standing and serve as a resource in competing for State and Federal transportation funding or grant funding from other sources.

Estimated Cost

$250,000

Cost-Benefit Analysis

Returns from this study are expected to be high, as it will result in projects that can prevent damage and disruption for critical facilities and infrastructure.

Potential Funding Sources

Engineering design and feasibility studies are eligible for funding through the Federal Emergency Management Agency (FEMA) Building Resilient Infrastructure and Communities (BRIC) program as a "project scoping" activity. Funding may also be available from USACE and the recently approved Infrastructure Investment and Jobs Act.

Required Permits or Approvals

No permits are required for this study.

Potential Challenges

The primary challenge to completing this project will be obtaining funding. Ideally, this study would be completed reasonably soon, so as to take advantage of the current, unique funding opportunities and to enhance preparations for mitigating the risks and vulnerabilities associated with future Lake Ontario flood events.

Basic Info

Location: Countywide, sites to be determined

Site owners: To be determined based on property owner interest

Jurisdiction: Various

Potential sponsors: Interested municipalities

Resiliency Area

Infrastructure Systems

Related Goals

Design with Nature

Complementary Projects

1 Local Laws to Increase Resiliency

Project #5

Porous Pavement
Reduction of Impervious Surfaces

Project Description

This projects proposes the installation of porous asphalt pavement throughout Monroe County, with particular focus on parking areas as the highest value targets and most easily adaptable areas for converting traditional (or impermeable) pavement to porous pavement.

Demonstrated Need

Municipalities are faced with ongoing challenges funding aging infrastructure repairs and improvements. Evidence shows that reducing impervious surfaces also reduces long term public infrastructure costs by reducing runoff, nuisance flooding, and improving water quality. In local lakefront areas, an increase in permeable surfaces will both reduce initial flooding impacts as waters rise and reduce recovery times as waters recede.

Potential Benefits

Compared to traditional pavement, porous pavement systems have many watershed-wide benefits, most notably:

- Reduced runoff and nuisance flooding during wet weather events
- Reduced peak flows and loads on stormwater infrastructure
- Improved water quality
- Reduced life-cycle costs compared to traditional pavement

Collectively, these benefits will allow municipalities to better and more cost-effectively manage runoff, mitigate overall flood volumes, and prevent roads and businesses from closing due to flooding. Reduction of stormwater runoff volumes and improvements in water quality are also fundamental goals for all regulated MS4 programs.

What is Porous Pavement?

Functionality

Porous pavements allows water to drain through the pavement surface and into the stone bed below. It then works its way into the soil, as nature intended, where any toxins on the surface of the asphalt or in the rainwater are filtered and the cleansed water is returned to the groundwater supply.

Traditional Asphalt

Porous Asphalt

Porous Concrete

Porous Pavers

Materiality

There are multiple types of porous pavement, including porous concrete, porous asphalt, and paving blocks. Porous asphalt has the lowest overall lifecycle cost for installation and maintenance. It is also ideal for low volume/ low-speed roadways, pedestrian walkways, sidewalks, driveways, and bike lanes.

Project #5

Porous Pavement
Reduction of Impervious Surfaces

Potential Benefits CONTINUED

Demonstrating the effectiveness of porous pavement will drive investment in the industry and increase opportunities for service providers to switch from traditional pavement to porous pavement as a new standard, as well as create job opportunities in this nascent industry.

Community Support

Benefits of porous pavement installations would be felt across entire communities, with all flood risk areas receiving the direct benefit of reduced runoff from upstream source areas.

Resilience Relative to Scenarios

High-water conditions: A higher percentage of pervious pavement in paved areas will help reduce flooding impacts on the rising and falling ends of the high water curve. As lake levels rise, pervious pavement will help keep areas open longer and reduce impact of high water at nuisance levels, such as occurs with wave over wash as lake levels rise but back bay and groundwater levels have yet to catch up. As all water levels reach a certain threshold, all pavement will be inundated regardless, and as such the material type will have no effect. As lake levels begin to drop, porous pavement will help those areas drain and recover more quickly after a high water event. In summary, porous pavement can help areas stay open and safe longer during rising waters, and recover more quickly as waters recede. Areas uphill from coastal lake level inundation will have their runoff contribution reduced downstream.

Low-water conditions: During low lake levels, porous pavement will still provide reduced runoff and water quality benefits. This is relevant for locations regardless of their coastline proximity. In fact, some evidence suggests that reducing runoff in headwater sections of the watershed has a disproportionate impact downstream.

Green Infrastructure Pays

A New York City green initiative designed to capture runoff from just 10% of impervious areas in the study area resulted in a 61.5% reduction in cost over traditional gray infrastructure.

In a Minnesota case study, researchers pointed to pervious pavement as having a superior stormwater handling and lower life cycle cost as opposed to traditional drainage structures.

Porous Pavement
Reduction of Impervious Surfaces

Implementation

Opportunities for implementation are much broader than just parking areas, however a focused approach relying on a single strategy has a greater chance of achieving success and having a tangible, measurable impact than a more general broad approach. By focusing on parking areas, and in particular public parking areas (supported and maintained by Monroe County municipalities) this strategy can begin to demonstrate the effectiveness of porous pavement and eventually expand beyond this initial limited scope.

The largest immediate benefit may be obtained by targeting parking areas associated with public properties (parks, utilities, boat launches). High priority areas include those associated with existing flood mitigation projects (such as REDI) and those that have the potential to incorporate public/private partnerships in converting adjacent or nearby private parking.

Porous pavement installation can be easily integrated into municipalities typical road maintenance and capital improvement project schedules. Projects can be categorized as either new parking area projects or repairs and repaving of existing projects.

Additional opportunities for implementing porous pavement may include a homeowner outreach and incentive program targeting driveways and a local business outreach plan focused on commercial parking areas. Public/private partnerships with private homeowners and businesses may help offset some project costs and further incentivize green infrastructure adoption.

Timeframe

1 to 2 years | 3 to 5 years | 5+ years

Estimated Cost

Porous Asphalt:[1] $10 to $15 per square foot installed

[1] Porous asphalt is typically assumed to be 10%-20% more expensive than standard asphalt, which generally costs between $7 to $13 per square foot installed.

Cost-Benefit Analysis

While porous pavement has known higher implementation costs compared to traditional pavement, those costs are mitigated by the reduction in associated stormwater management design, construction, and maintenance.

Project #5

Porous Pavement
Reduction of Impervious Surfaces

Cost-Benefit Analysis CONTINUED

Traditional stormwater best management practices not only have to be designed and built alongside traditional pavement projects (roads, parking lots, etc.), but also have ongoing life-cycle costs associated with maintaining proper performance. Those stormwater maintenance costs are reduced or eliminated with porous pavement. Porous pavement can also last up to twice as long as traditional pavement with proper installation and maintenance. It should be noted that porous pavement does need more maintenance than traditional asphalt to upkeep and extend its life.

Potential Funding Sources

Any local, state, federal, private, or non-profit funded projects that include paving in any way could support porous pavement just as readily as traditional pavement. Additional special funding sources are not necessarily required.

Required Permits or Approvals

Construction activities resulting in the disturbance of less than 1-acre generally do not require a NYSDEC Stormwater Permit. Projects larger than 1 acre will require on site erosion and sediment control plans to be approved and permitted by the NYSDEC under the SPDES General Permit for Stormwater Discharges from Construction Activity - GP-0-20-001. No new additional permitting beyond local jurisdiction construction permits and standard SEQRA review is anticipated.

Potential Challenges

Public agency confidence in long term maintenance and performance: Other than occasional pilot demonstration projects, porous pavement does not have a longstanding inventory of project implementations in Monroe County. A survey conducted within the CLEAR Steering Committee found that municipal leaders seek additional outreach and cataloging of "lessons learned" from locally implemented projects to build confidence around a collective understanding of maintenance and performance costs for porous pavement installations.

Capacity/experience with existing installation contractors: The perspectives and attitudes of existing contractors in adopting porous pavement as a known, trusted, and common practice is a significant barrier to the necessary long-term shift in prioritization and resource availability. Investment by public sector agencies on all publicly funded projects as a priority can help drive this shift.

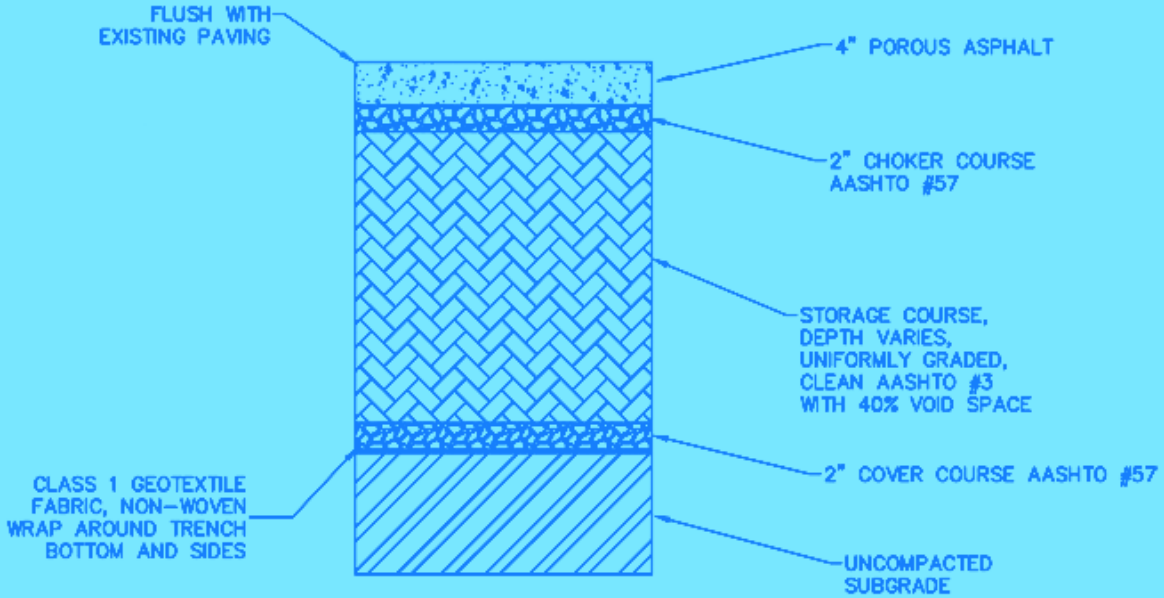
Best Practices for Implementation

Design

The National Asphalt Pavement Association recommends that a typical cross-section for porous asphalt pavements should consist of the porous asphalt layer on top, a choker course, a stone subbase recharge bed, a non-woven geotextile fabric and uncompacted subgrade.

The thickness of the top asphalt layer will vary depending on the expected traffic loads:

- Parking (little or no trucks): 2.5"
- Residential (some trucks): 4.0"
- Heavy (many trucks): 6.0"



Additional Resources

Design guidance can also be found in:

- NYSDOT Standard Specifications, Section 420 (January 2018)
- Oregon DOT Pavement Design Guide (January 2019)
- University of New Hampshire Stormwater Center Design Specifications (September 2016)

Basic Info

Location: Edgemere Dr. in Greece; Irondequoit Bay Beach/Sea Breeze Pier and Beach in Irondequoit; Westage at the Harbor in Irondequoit

Jurisdiction: NYSDEC

Potential sponsors: USACE

Potential partners: Towns of Greece and Irondequoit, NYSDEC, NYSG

Resiliency Area

Infrastructure Systems

Related Goals

- Design with Nature

Complementary Projects

- 14 Regional Modeling in the Rochester Embayment
- 7 Near-Shore Wave Energy Attenuation System
- REDI Multiple REDI Projects (see sidebar)

Project #6

Shoreline Protection in Greece and Irondequoit

Project Description

This project proposes the planning, design, and construction of offshore, detached, segmented living breakwaters (either submerged or emergent) and/or artificial reef structures to reduce erosive wave energy and enhance beach growth along Edgemere Dr. in the Town of Greece and near Irondequoit Bay Beach/Sea Breeze Pier and Beach and Westage at the Harbor in the Town of Irondequoit. It also includes beach restoration and re-nourishment at Irondequoit Bay Beach and Sea Breeze Pier and Beach.

Demonstrated Need

Edgemere Drive: Results from the Risk Assessment identified homes on Edgemere Drive as assets with severe risk, meaning that these residences are in a dangerous situation that necessitates the reduction of exposure and vulnerability and may require relocation. Based on data from the U.S. Army Corps of Engineers (USACE), the portion of Edgemere Drive from Crescent Beach to Beach Avenue has some of the highest projected rates of erosion in the Study Area.[1] These areas are expected to see accelerated rates of erosion – upwards of one-foot per year. In 2017 and 2019, Edgemere Drive was closed after severe flooding impacted the area. Some homes on Edgemere Drive are at risk to high waters from both Lake Ontario and the Braddock Bay/Pond Complex on the southern side of the road.

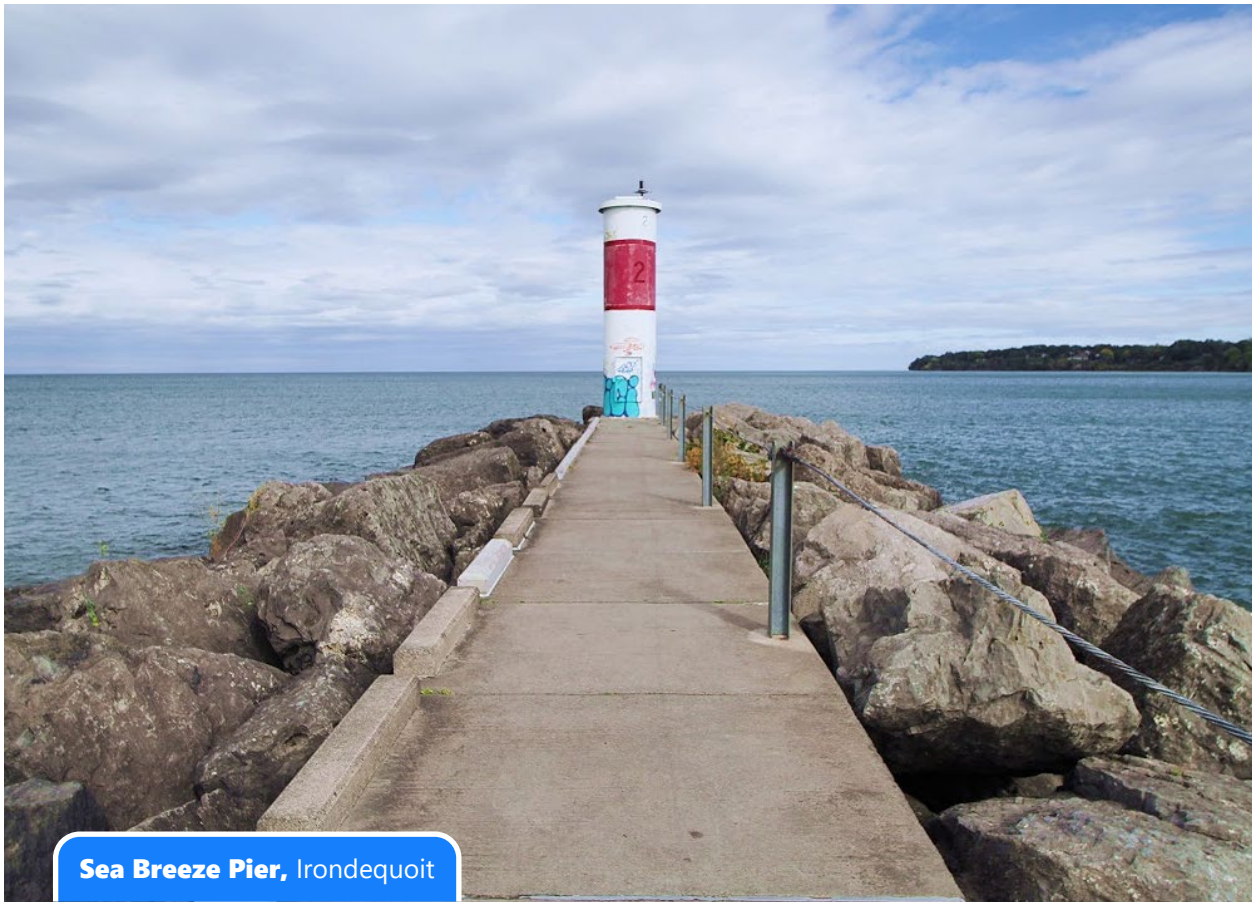
1 USACE (2019). Lake Ontario Natural and Nature Based Feature Opportunities. Retrieved from https://lrb.maps.arcgis.com/apps/MapSeries/index.html?appid=90201bae2b2c410fab28ff2464c251d9


Homes on Edgemere Drive, Greece
Homes on Edgemere Drive have a history of flooding during high water events and are projected to be at severe risk of flooding in future events.
Some homes face double exposure from Lake Ontario and Braddock Bay.

Project #6

Shoreline Protection in Greece and Irondequoit

Sea Breeze Pier and Beach/ Irondequoit Bay Beach: Sea Breeze Pier and Beach and Irondequoit Bay Beach are also at a high risk to coastal hazards. According to the USACE, the shoreline at Sea Breeze Pier and Beach and Irondequoit Bay Beach has experienced historical erosion rates of 1.57 feet per year, meaning that the shoreline is naturally retreating 157 feet over 100 years. This is a very high rate of erosion (80th to 90th percentile).[2] During the 2019 high water events, businesses along the beach including Marge's Lakeside Inn were forced to closed.

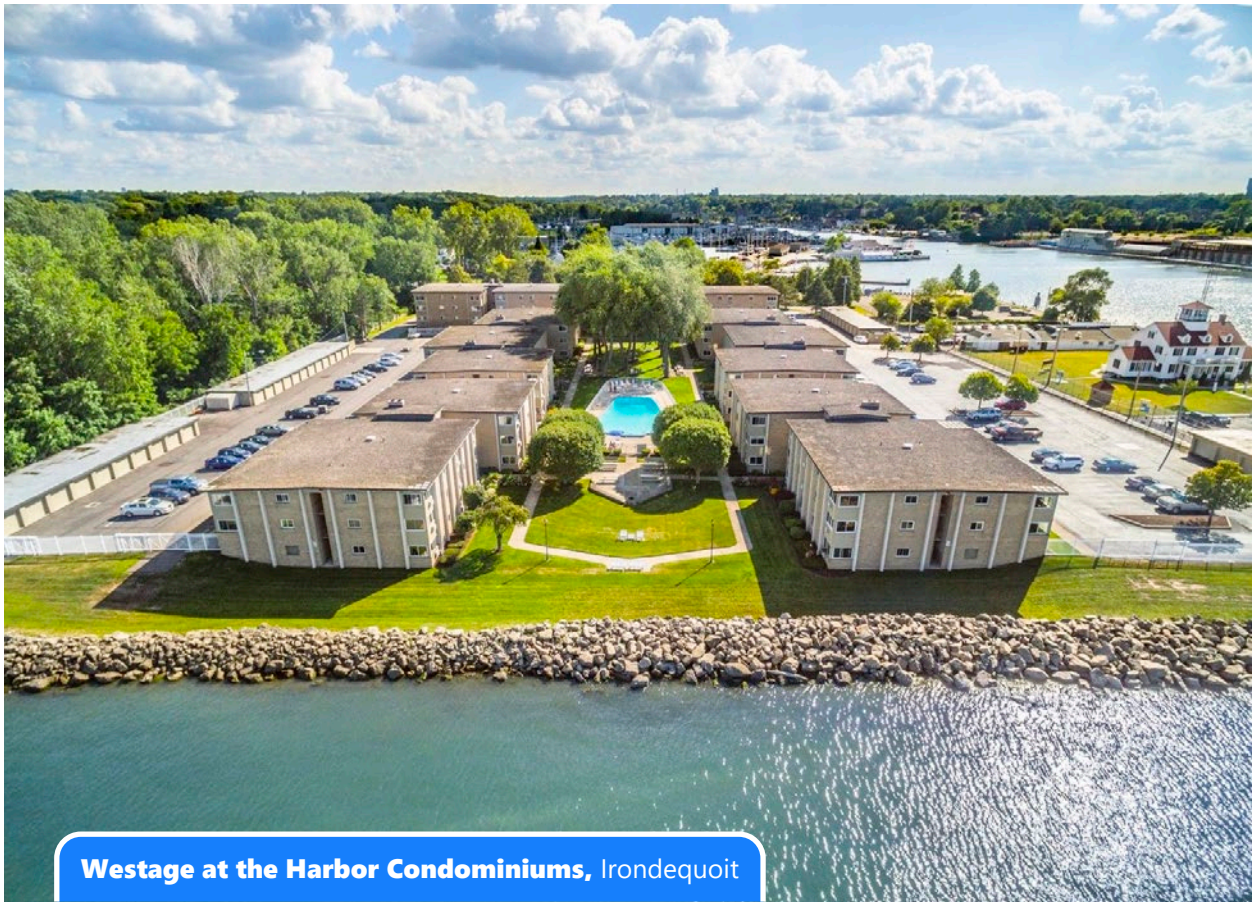


Sea Breeze Pier, Irondequoit

2 USACE (2019). Lake Ontario Natural and Nature Based Feature Opportunities. Retrieved from https://lrb.maps.arcgis.com/apps/MapSeries/index.html?appid=90201bae2b2c410fab28ff2464c251d9

Shoreline Protection in Greece and Irondequoit

Westage at the Harbor: The Westage at the Harbor includes 14 buildings with 162 single-family condominiums, which were impacted by high water events in 2017 and 2019 and are at high risk to future flooding. During those high water events, pumping was required to hold back water overflowing from the revetment wall along Lake Ontario and groundwater flooding. The ground floors of the complex may flood if lake levels rise above about 249.5 feet. Significant flooding experienced in 2017 may repeat during an event in which 4-to-6-foot wind driven waves are trapped against the Rochester Harbor East Jetty to the west of the condominiums. This jetty is known to reflect waves during storm events causing an amplification in wave height at the property shoreline. The beach, revetment, and east property garage foundations experience erosion.



Westage at the Harbor Condominiums, Irondequoit

Project #6

Shoreline Protection in Greece and Irondequoit

Potential Benefits

Shoreline protection structures will protect human health and safety and prevent future property damage along the shoreline. Shoreline protection will also allow for the continued use and enjoyment of waterfront recreation and commercial activity along the shoreline. Structures may also protect the Braddock Bay Wildlife Management Area and Irondequoit Bay from coastal hazards.

Community Support

The Director of Development Services, Planner, and Town Engineer from the Town of Greece, the Commissioner of Public Works at Town of Irondequoit, and the Monroe County Soil & Water Conservation District have all expressed support. Community members support pursuing economic, recreational, and tourism opportunities with innovative resilient strategies and conserving and restoring the nearshore and coastal natural environment to support the Great Lakes ecosystem. This project will advance both those objectives.

Resilience Relative to Scenarios

High-water conditions: Breakwaters reduce wave energy at the shoreline, reduce flooding and erosion if properly designed and maintained, and reduce vulnerability to flooding. Emergent breakwaters are particularly well suited to achieve storm damage reduction and reduce flooding in high-water conditions. Sediment management of the Lake Ontario littoral zone also provides an opportunity to reduce flooding and erosion as well as the risk of significant erosion or property damage.

Low-water conditions: Segmented breakwater structures do not pose risks during low water conditions, as they are not continuous and allow water to move between them. Sediment management during low water levels is also adaptable.

Implementation

Alternatives Analysis

The first step in any shoreline management project is to consider alternatives. No action and non-structural measures should be considered first. If those options are not viable, then nature-based solutions should be evaluated. Lastly, hard structural measures should be evaluated. If a hard structural measure is proposed, justification in the permit application needs to explicitly address why a no-action, non-structural, and nature-based measure is not appropriate at the site.

Shoreline Protection in Greece and Irondequoit

Environmental Review and Permitting

Implementation of this shoreline protection strategy would require complex environmental review and permitting involving numerous State and Federal governmental agencies with jurisdiction over Lake Ontario waters. Sediment transport modeling must be conducted to determine if there may be undesirable impacts downdrift of proposed structures. Ultimate phasing will be informed by the Regional Modeling in the Rochester Embayment proposed project which will analyze waves, hydrodynamics, and sediment transport.

Timeline

Preliminary installation could be complete by 2025 and relative reductions in observed wave heights on the shore breakwaters, consequent reductions in overland flooding, and beach width stabilization could be observed as early as 2030 and into the 2050s.

Timeframe

1 to 2 years | 3 to 5 years | **5+ years**

Estimated Cost[2]

$50 to $100 million

[2] The construction of 58 segmented breakwaters in Preque Isle, PA cost $61 million in original costs with another $60 million over 50 years for operating costs related to beach maintenance. The Living Breakwaters Project off of Staten Island includes approximately 2,400 linear feet of breakwaters, shoreline restoration, oyster restoration, and education for $107 million. Costs vary significantly based on location, length, and complexity of design.

Cost-Benefit Analysis

The total project cost will be offset by the benefits of avoided threats to human health and safety, avoided future property damage, the protection and preservation of ecosystem services from wetlands and wildlife habitat in the Braddock Bay Wildlife Management Area and Irondequoit Bay, and the benefits of tourism, commercial and recreational activities along the shoreline.

Potential Funding Sources

Engineering design and feasibility studies are eligible for funding through the Federal Emergency Management Agency (FEMA) Building Resilient Infrastructure and Communities (BRIC) program as a "project scoping" activity. Funding for the implementation of sediment control projects are also eligible for FEMA Hazard Mitigation Assistance (HMA) grant programs. To

Project #6

Shoreline Protection in Greece and Irondequoit

qualify for FEMA HMA funding, this project must be included in the Monroe County All-Hazard Mitigation Plan. These funding programs also typically involve a local cost-share of 25% of the project cost which may include State grant funding and/or municipal funds.

Nationally-competitive funding for coastal resilience projects are also available from the National Fish and Wildlife Foundation (NFWF).

Funding for feasibility studies is also available through a partnership with the USACE.

As of April 2021, the Town of Greece is a Class 6 FEMA Community Rating System (CRS) eligible community, meaning that homeowners in the Town receive a 20% discount on their flood insurance if their property is located in the SFHA.

Additional flood resilience measures, including this project, may earn the Town points in the CRS program, thereby lowering its CRS class and lowering homeowner's flood insurance premiums.

Required Permits or Approvals

The following permits may be necessary to implement this project:

- NYSDEC Coastal Erosion Management Permit
- NYSDEC General Permit or Individual Permit for Great Lakes Erosion Control
- NYSDEC Freshwater Wetlands Permit
- NYSDEC Protection of Waters Permit
- NYSDOS Coastal Consistency Concurrence
- Water Quality Certificate
- USACE Nationwide Permit
- USACE permit under Section 404 of the Clean Waters Act

Potential Challenges

Unwanted Side-effects

Breakwaters may interrupt the view of the horizon and can be a risk to navigation if they are hidden below the water level.

Cost and Permitting

Breakwater structures require considerable study and computer modeling to design properly and are quite expensive. Care will need to be taken that appropriate studies are completed and nature-based approaches have been fully considered before moving forward with this project.

Complementary REDI Projects

Adjacent to Project Sites

Basic Info

Location: To be determined

Jurisdiction: Various State and Federal agencies

Potential sponsors: NYSDEC, USACE, US EPA

Potential partners: New York SeaGrant

Resiliency Area

Infrastructure Systems

Related Goals

- Design with Nature

Complementary Projects

- 14 Regional Modeling in the Rochester Embayment
- 2 Shoreline Data Needs Planning Study
- 6 Shoreline Protection in Greece and Irondequoit
- USACE Braddock Bay Restoration

Project #7

Near-Shore Wave Energy Attenuation System

Project Description

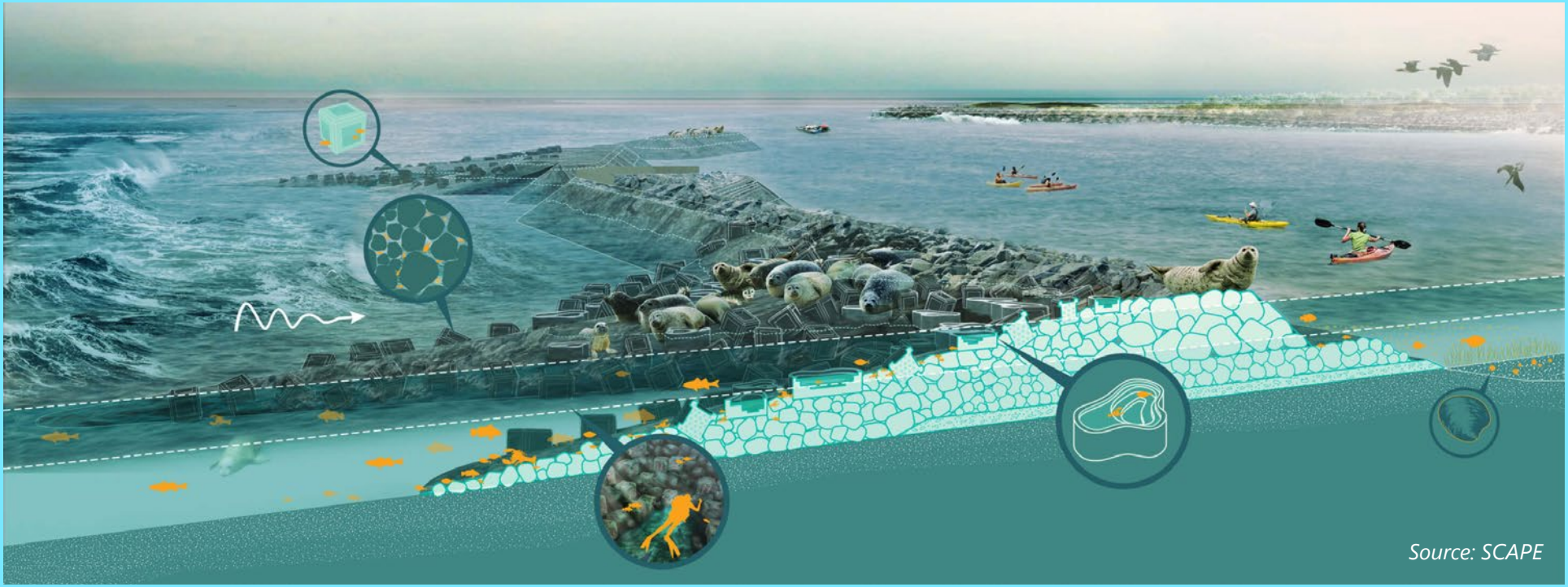
This project seeks to pursue funding to study, identify, and potentially design and construct a series of detached segmented breakwater structures to provide near-shore wave attenuation and resulting shoreline erosion management and protection.

Demonstrated Need

There are significant reaches of the Lake Ontario shoreline within the Monroe County CLEAR study area which were severely impacted during the high lake levels experienced in 2017 and 2019. During high lake levels wave action overtopped and damaged existing shore-based shoreline protection structures, and existing housing stock and eroded natural shorelines. There are many design publications available that provide guidance to shoreline property owners on erosion and shoreline protection techniques, ranging from softer natural approaches (i.e. vegetation, edging, sills) to harder structural on-shore techniques (i.e. stone revetments, steel and concrete bulkheads). The on-shore structural techniques such as revetments and bulkheads are intended to retain the existing soil at the shoreline, preventing retreat from erosion, but they often result in the loss of the natural beach on the lake side of the structure, due to wave action. Typically, application of these on-shore techniques is limited to a relatively short length of shoreline within the existing property lines of an individual property or to a small grouping of neighboring properties that have like-minded owners. Treatments must be transitioned at the outer limits of the property to meet existing treatments at adjacent properties,

Case Study

Living Breakwaters | Staten Island, NY



The Living Breakwaters project on the south shore of Staten Island will consist of a series of nine breakwater segments totaling 2.400 linear feet. The breakwater segments are specially designed with reef-like features to promote biological activity and create habitat for marine species, including the oysters which historically thrived in this area. The breakwaters were engineered to reduce waves reaching on-shore buildings and roads to below 3 feet in height during 100-year storm events, assuming up to 18 inches of sea level rise. The project, designed by SCAPE, was developed in response to the effects of Superstorm Sandy, is funded in part by the U.S. Department of Housing and Urban Development (HUD) and the NYS Governor's Office of Storm Recovery (with a total project cost of $107 million), and is expected to be completed in 2025.

Potential Application for CLEAR:

A "living" breakwater system in Lake Ontario could help restore native fish and wildlife biodiversity and habitats – a goal identified in the DEC 2014 Action Agenda for the Great Lakes Basin. Potential target species could include: Atlantic salmon, lake sturgeon, American eel, and lake trout.

Project #7

Near-Shore Wave Energy Attenuation System

resulting in a patchwork approach to shoreline erosion management. This project aims to explore a technique for shoreline protection that can provide greater protection during high lake levels, over a wider reach of the shoreline.

Potential Benefits

A broad scope near-shore, permanent breakwater wave attenuation system that is detached from the shoreline, can be designed to positively influence a significant length of shoreline. It can protect numerous adjacent properties, or a neighborhood community, by providing long-term wave attenuation, increasing beach formation, and decreasing the damaging effects of wave action on the shoreline, even during extreme high lake level flood events.

Community Support

While there is community interest in exploring what might be accomplished within the Monroe County CLEAR Study Area using this shoreline protection technique, further investigation is needed to identify a suitable site where the benefits of this technique can be fully realized.

Resilience Relative to Scenarios

The construction of a near-shore wave attenuation structure is likely to provide the greatest benefit during high-water conditions, when mitigation of wave action can help reduce damaging effects on the shoreline and infrastructure. During low-water conditions, the wave mitigating effect of this type of structure is minimized, however beach formation can continue.

How Breakwaters Work

Breakwaters constructed as shore-parallel structures detached from the actual shoreline can be designed to provide protection to a significant length of shoreline by attenuating, reflecting and diffracting wave energy, and creating a calmer region toward the shore side of the structures. The detached breakwaters can be constructed entirely below the water surface, functioning much like an offshore reef, or protruding above the water surface for greater mitigating effect during flood events (with the potential disadvantage of interrupting the aesthetic views out to the horizon).

Case Study

Presque Isle State Park | Erie, PA

The near-shore segmented breakwater technique was used at Presque Isle Peninsula State Park at the east end of Lake Erie. Construction of 55 rubble-mound breakwater segments – each measuring 46 feet in length, with gaps of 107 feet between segments and positioned between 76 and 107 feet from shore – were completed in 1992 to control erosion of the peninsula, enhance beach sand nourishment activity, and maintain habitat for endangered species. Each year, the peninsula relies on 38,000 cubic yards of additional sand to offset the erosion. Since the construction of the breakwaters, the annual amount of sand nourishment required has been diminished by 75%.

Potential Application for CLEAR:

The Presque Isle breakwaters serve as proof of concept for this type of segmented breakwater structure in the Great Lakes environment.

Project #7

Near-Shore Wave Energy Attenuation System

Implementation

Alternatives Analysis

The first step in any shoreline management project is to consider alternatives. No action and non-structural measures should be considered first. If those options are not viable, then nature-based solutions should be evaluated. Lastly, hard structural measures should be evaluated. If a hard structural measure is proposed, justification in the permit application needs to explicitly address why a no-action, non-structural, and nature-based measure is not appropriate to manage risk at the site.

Identify Breakwater Type

There are three main types of breakwaters (rubble-mound, vertical wall, and floating) that could each be considered, as well as hybrid types that involve a combination of techniques, but the selected approach would need to take into account the ecology of this freshwater lake, the climate (including seasonal winter ice formation), anticipated seasonal wave patterns and the high wave energy anticipated, especially during high water flood events.

Identify Project Location

The shoreline reach chosen for the project could include:

- A lakeshore community of densely developed residential properties hampered by minimal remaining shoreline setbacks, and where available shore-based erosion management options constructed by individual property owners are not providing adequate protection to the homes and property (e.g., Edgemere Drive in the Town of Greece, or Wautoma Beach neighborhood in the Towns of Parma & Hilton).
- A length of shoreline with existing lake access focused commercial land, such as a marina, where creating a sheltered region adjacent to the shore offers economic development benefits.
- A critically important natural area experiencing wave action during flood events that results in damaging loss of natural habitat or environmental function.

Environmental Review and Permitting

Implementation of this shoreline protection strategy would require complex environmental review and permitting involving numerous State and Federal governmental agencies with

Near-Shore Wave Energy Attenuation System

jurisdiction over Lake Ontario waters. Sediment transport modeling must be conducted to determine if there may be undesirable impacts downdrift of proposed structures.

Timeframe

1 to 2 years | 3 to 5 years | **5+ years**

Estimated Cost[1]

$50 to $100 million

[1] The construction of 58 segmented breakwaters in Preque Isle, PA cost $61 million in original costs with another $60 million over 50 years for operating costs related to beach maintenance. The Living Breakwaters Project off of Staten Island includes approximately 2,400 linear feet of breakwaters, shoreline restoration, oyster restoration, and education for $107 million. Costs vary significantly based on location, length, and complexity of design.

Cost-Benefit Analysis

While the cost of a nearshore breakwater structure can be significant, the benefits translate into significant improvements in stormwater and flood protection. When coupled with on shore natural resiliency measures this becomes a valuable tool to ensure improved resiliency and safety for the areas involved.

Potential Funding Sources

On the national level, the passage of the Infrastructure Investment and Jobs Act includes funding for transportation infrastructure, inland waterways, environmental infrastructure, natural resources and other environmental infrastructure like watershed programs. The Great Lakes Restoration Initiative also includes flood mitigation efforts. Other agencies that have funded projects related to flooding include FEMA, the National Fish and Wildlife Foundation, NOAA's Office for Coastal Management, and others.

Required Permits or Approvals

Construction of a detached breakwater to protect a segment of the Lake Ontario shoreline will require careful environmental review and permits from various regulatory agencies, including DEC, USACE, DOS, and potentially other agencies depending upon the site location and proposed improvements.

Since nearshore breakwaters are costly to construct, require significant technical data, study, permitting, and design, and can have unintentional impacts, an engineering company specializing in coastal engineering should be retained to support this effort. It is recommended by DEC that for any project that is undertaken, the parties should seek an

Project #7

Near-Shore Wave Energy Attenuation System

audience with DEC, DOS, and USACE at the outset of the project to discuss permitting of any off shore breakwater project and discuss the step-by-step process to seek and obtain the necessary permits (see sidebar).

Potential Challenges

Detached breakwaters have been used extensively in other countries around the world, protecting miles of shoreline. However, their use in the United States has been lagging behind, primarily due to the relatively high cost of construction, complexity of design and modeling considerations, and the lack of extensive experience with ultimate performance in the United States.

Unwanted Side-effects

These structures depending upon their position and how they interact with wave action, can positively or adversely affect the longshore movement of sand material resulting in potential impacts to shoreline beyond the breakwater's limits. The change in movement of sand can cause undesirable effects if not carefully considered, modeled, and studied during the design phase. Depending upon their placement, breakwater structures could have an effect on navigation that must be considered and may also impact shoreline views.

High Cost

The cost of breakwaters is high and increases dramatically with increased water depth. However, near-shore breakwater structures would likely have a service life of up to 50 years or more.

Extensive Permitting

There is a high regulatory bar for offshore breakwaters and, while not impossible, it would likely be difficult to attain regulatory approval for this type of project. The permit process would likely be intensive and require significant study. Nature based approaches should be considered and potentially included in the overall design of the project. The design should also be informed by all available data including that from the Shoreline Data Needs Planning Study and the Regional Modeling in the Rochester Embayment proposed projects. Actively engaging with the relevant permitting agencies and affected constituents would also aid the process.

Guidance for Permit Applications

From NYS DEC

1 Identify Level of Protection

Determine the need for erosion protection and/or flood protection and how much protection is required and where.

2 Conduct an Alternative Analysis

Identify a strategy that provides the appropriate protection while minimizing negative impacts. Alternatives may include structural and non-structural alternatives or perhaps a combination of both. Examples might be off-shore stone breakwater or floating wave attenuation measures coupled with on-shore nature-based resilient plantings. Other alternatives could be the redesign of current flood and erosion protection for increased uniformity in design, materials, and detail. Such changes might include a lakeside return at the top of a vertical wall to direct wave energy back toward the lake or adding flood/wave resilient plantings to absorb wave energy and reduce erosion.

3 Select Permit Application Form

Depending on the results of Step 1 and 2, the permitting process currently has two options:

Option 1: Joint Application Form and other authorizations from DEC, DOS, OGS. A link to this form can be found on the DEC website along with other forms you may need to include with your application, such as an Environmental Assessment Form or a Consistency Assessment Form.

Option 2: General Permit Application Form. After the flooding on Lake Ontario in 2017 and 2019, DEC issued this type of permit for property owners to repair and stabilize their properties damaged by high water levels. The General Permit Application Form was intended to make the permitting process quicker and simpler for shoreline recovery projects. It is unlikely that this permit form will be helpful with off-shore projects, other than the possibility that it may be a factor in Step 2 above if any property owner considered repairs or modifications to any existing on-shore flood and erosion protection.

4 Complete and Submit Application

If completing a General Permit Application Form, follow the written directions provided with the form.

If completing an application for an individual permit, the *New York State REDI: Building Resilience in Recovery, Homeowner Program Guidance for Shoreline Management* document lists the typical items required for inclusion in the Joint Application Form, Federal Coastal Consistency Assessment Form, and Environmental Assessment Form. A description of the project, explanation of why it is the preferred alternative and why a non-structural alternative or nature-based approach is not appropriate, site plan, photos of the location, construction methods, description of how adverse impacts to natural features and processes will be minimized, and a maintenance plan are also required. (If within a DEC-identified Coastal Erosion Hazard Area, you may use a CEHA permit application checklist.)

Basic Info

Location: Countywide

Site owner: Not applicable

Jurisdiction: Monroe County

Potential sponsors: Monroe County Economic Development

Potential partners: Local economic development officials, chambers, BIDs

Resiliency Area

Economic Recovery

Related Goals

- Resilient Economy

Complementary Projects

1. Local Laws to Increase Resiliency

Project #8

Lakeshore Business Retention + Resiliency Program

Project Description

This is an economic development program designed to retain shoreline businesses and support their ability to respond and adapt quickly to water-level related disruptions that can threaten operations, people, assets, or even brand reputation. County and local officials will regularly connect with businesses to understand needs, identify problems and trends in the lakeshore business community, and use this information to design mitigation measures that will support the shoreline business community.

Demonstrated Need

High, low, and fluctuating water levels affect lakeshore businesses and can impact their ability to operate and may limit their sales. This project will help create and strengthen relationships between shoreline businesses and service providers. Strong relationships are critical during flooding events to help distribute emergency and recovery resources quickly and efficiently and to help businesses continue operations.

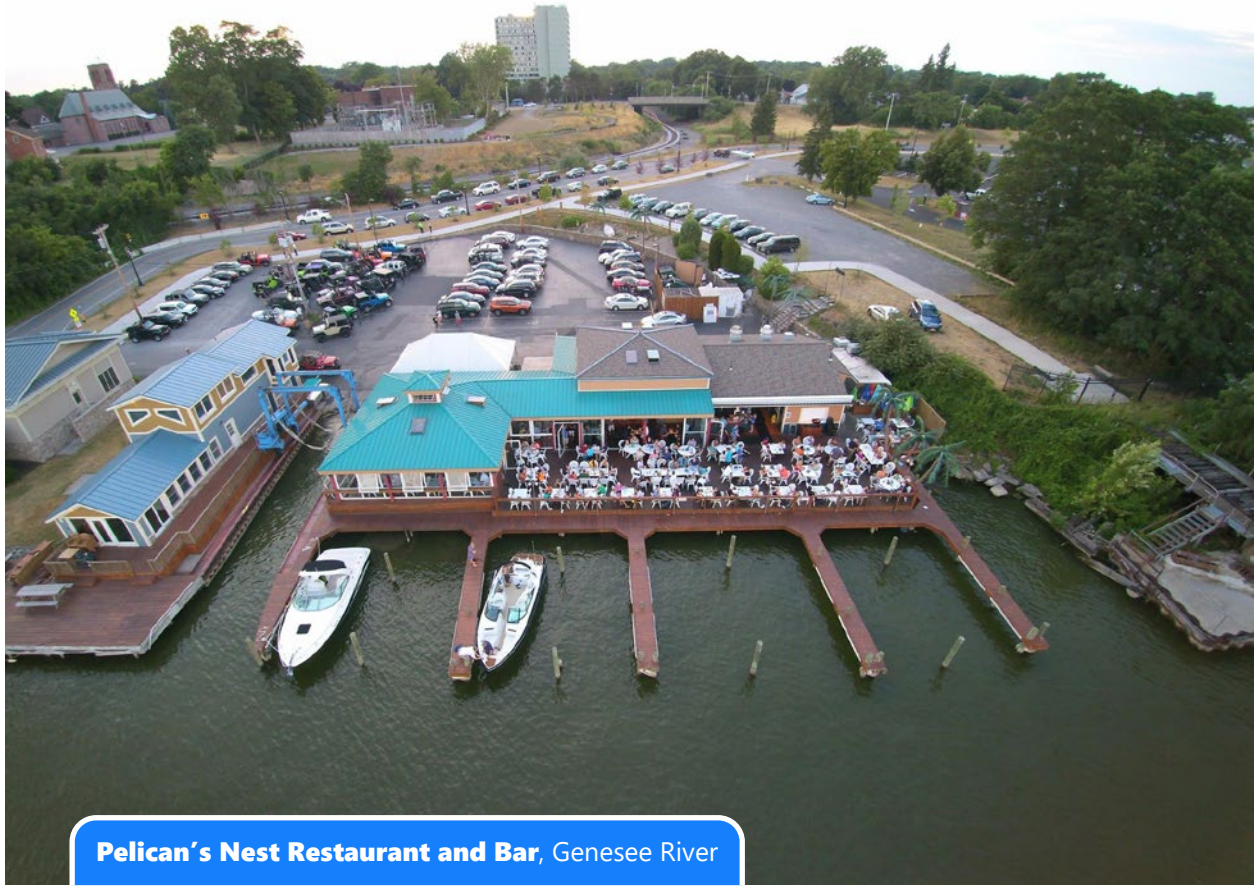
Potential Benefits

By proactively identifying and addressing day-to-day and flood event related challenges of shoreline businesses, those businesses will be better able to continue operating in the county, thus sustaining jobs, tax revenue, income, and economic activity.

Community Support

Business owners surveyed for the CLEAR Plan were interested in a program like this to improve communication among businesses and between local

Lakeshore Business Retention + Resiliency Program



Pelican's Nest Restaurant and Bar, Genesee River

governments and to ensure that needs are heard and addressed as quickly as is reasonably possible in disaster scenarios.

Resilience Relative to Scenarios

In both high- and low-water scenarios, connecting with businesses to understand their needs and concerns will support their resilience and growth. Support can come in a variety of ways. Examples include: financial assistance for physical property improvements to adapt to high- or low-water conditions, technical assistance such as continuity planning to help businesses prepare for flooding events, or assistance with adapting operations or business models over the longer-term to new water level conditions.

Project #8

Lakeshore Business Retention + Resiliency Program

Implementation

Design of the program could begin immediately after funding is secured, and implementation would be ongoing. The business engagement process will include:

1. Development of a survey tool with a standard set of questions each business will be asked to respond to.
2. Identify staff and recruit volunteers to conduct business engagement (visits or calls).
3. Train volunteers on outreach process and organize outreach by assigning volunteers to specific businesses, scheduling visits, and setting timeframes.
4. Volunteers conduct outreach and submit information from surveys back to the County in a timely manner.
5. County to analyze information from businesses using database to store and track data.
6. Follow up with resources, connections, and information to businesses as needed.
7. Working with volunteers and economic development partners, use the information collected to develop strategies for collective action in response to identified needs.

Timeframe

1 to 2 years[1] | 3 to 5 years | 5+ years

[1] It is relatively easy to implement a Business Retention + Resiliency Program if the County already utilizes a Customer Relationship Management (CRM) platform for other communications or programs.

Estimated Cost

Annual cost:[2] $5K to $10K

[2] Estimated cost is based on the cost for a CRM platform, which generally runs a few hundred dollars a month for basic packages. Additional cost is associated with the staff-time necessary to properly run the program.

Cost-Benefit Analysis

The investment of county staff time will support the retention and growth of shoreline businesses, which will retain jobs, property tax revenue, and economic activity in the county.

Performance indicators: Several measures can be used to test the efficacy of the program, including whether it has been capable of retaining the current level of economic activity, including number of businesses, jobs, and sales, despite fluctuating water levels.

Lakeshore Business Retention + Resiliency Program

Potential Funding Sources

– Community Development Block Grant (CDBG) Disaster Recovery Program

Required Permits or Approvals

Not applicable for the Business Retention program itself; however, it is anticipated that some initiatives that come out of this program will require approvals.

Potential Challenges

The biggest challenge with these types of programs is implementation. It is relatively easy to design the program, but recruiting volunteers, scheduling business visits, analyzing the data, and acting on the findings requires an ongoing commitment to the program.

Case Study | Westbrook, Maine

As the COVID-19 pandemic began, the City of Westbrook, ME recognized they needed to quickly engage their main street businesses to understand their needs, track information collected, and respond with appropriate resources and action. The City sought funds through the Community Development Block Grant (CDBG) Disaster Recovery Program to design and launch a new Business Recovery + Retention Program. The funds were used to retain a consultant team, who worked with City staff to design the program, set up a CRM system to store and track business intelligence, and develop a business engagement strategy. In a matter of weeks, the City connected with 160 small businesses to understand what they needed to withstand the economic disruption caused by the pandemic, and responded with direct support as well as policies and programs designed to mitigate systemic challenges.

Basic Info

Location: Countywide

Site owner: N/A

Jurisdiction: Monroe County

Potential sponsors: Monroe County Economic Development

Partners: Interested municipalities

Resiliency Area

Economic Recovery

Related Goals

- Resilient Economy

Complementary Projects

- 10 Fiscal Impact Analysis for Shoreline Municipalities
- 12 Regional Buyout Lease-Back Housing Program

Project #9

Cost-Conscious Communities Program

Project Description

As part of this program, each community commits to tracking all costs associated with recovery and mitigation from water-level events, including local, state, and federal costs. Data can be aggregated regionally and used for public education and engagement, as well as for future decision making and when seeking financial support.

Demonstrated Need

Tracking recovery and mitigation costs is important for projecting future costs and for right-sizing municipal budgets. Municipalities also collect recovery and mitigation cost information differently, so standardizing data collection across the county will allow better-informed decision making in the future about the actual cost of events.

Potential Benefits

A record of past costs associated with storm and water-level events can help municipalities more accurately predict and prepare for the costs of future events. Tracking these costs can also be helpful in performing cost-benefit analyses and evaluating the fiscal impact of resiliency projects, like mitigation infrastructure or regulatory policies, for example.

Community Support

While this project is not necessarily a public-facing project, its benefits will help save taxpayer money. Municipalities who can effectively justify their need for financial support for resiliency projects or emergency costs are more likely to receive funding from state and federal governments for these needs.

Cost-Conscious Communities Program

Resilience Relative to Scenarios

This program focuses primarily on growing economic resilience to high-water scenarios as these scenarios are most likely to result in recovery costs (i.e. emergency response or rebuilding costs) or mitigation costs (i.e. projects to prevent damage from future events) for municipalities. If municipalities experience costs from low-water scenarios, the program can be expanded to track these costs as well.

Implementation

Implementation of this project would begin at the County level, with County officials designing the program and outlining the requirements and then encouraging local municipalities to join.

Timeframe

1 to 2 years | 3 to 5 years | 5+ years

Estimated Cost

Annual cost: $10K to $25K

Cost-Benefit Analysis

The purpose of this program is to give municipalities a more accurate understanding of the amount of fiscal resources they will need to respond to water-level related events so that this need is planned for in annual budgets and that these resources area available when needed. This program would also provide communities with quantitative justification for budgeting for these types of "rainy day," oft-overlooked, and not particularly politically-attractive costs.

Potential Funding Sources

– Community Development Block Grant (CDBG) Disaster Recovery Program

Required Permits or Approvals

This project does not require permits, review, or approvals to implement.

Potential Challenges

Demonstrating the need for municipalities to change their internal processes for tracking and reporting this type of data may prove difficult. The County could consider some sort of incentive structure to encourage participation among municipalities.

Basic Info

Location: Countywide

Site owner: N/A

Jurisdiction: Monroe County

Potential sponsors: Monroe County Economic Development

Partners: Interested municipalities

Resiliency Area

Economic Recovery

Related Goals

- Resilient Economy

Complementary Projects

- 9 Cost-Conscious Communities Program
- 12 Regional Buyout Lease-Back Housing Program

Project #10

Fiscal Impact Analysis for Shoreline Municipalities

Project Description

This project recommends that CLEAR municipalities conduct fiscal impact analyses to quantify the public costs and revenues associated with flood-prone areas in their communities so that these costs can be used as a fiscal baseline for decision making and for weighing future adaptation and mitigation projects.

Demonstrated Need

As costs to prepare for and recover from flooding and high-water events are likely to increase into the future, it is important for municipalities to track, understand, project, and responsibly react to these changes. It will become increasingly important to weigh the costs of certain decisions, like building and re-building houses in flood-prone areas, against their benefits.

Potential Benefits

Establishing a fiscal baseline for flooding costs will help municipalities compare the costs of potential policy changes or adaptation and mitigation projects to determine if they are fiscally beneficial to their communities.

Community Support

The Town of Greece participated in a beta-test fiscal impact analysis as part of the CLEAR Plan development. The Town intends to use the findings of the analysis to help inform anticipated development on its shoreline. Other municipalities could benefit from a fiscal impact analysis in the same way.

Resilience Relative to Scenarios

A fiscal impact analysis evaluates how deviations from normal impact municipalities' bottom lines. As such, modeling could be used to quantify

Fiscal Impact Analysis for Shoreline Municipalities

potential fiscal impacts of both high- and low-water scenarios.

Implementation

This project would begin by quantifying the total assessed value and property tax revenue generation in an identified study area. In collaboration with municipal officials, flood costs that have been incurred in past flooding events would be collected and aggregated. Scenario modeling would then be used to project how the municipality's fiscal bottom line could be impacted in the future if homes and businesses are regularly or permanently inaccessible due to floods.

Timeframe

1 to 2 years | 3 to 5 years | 5+ years

Estimated Cost

$10,000 per municipality

Cost-Benefit Analysis

The relatively minimal upfront costs of conducting a fiscal impact analysis will help municipalities make more informed decisions about projects that are magnitudes more expensive.

Potential Funding Sources

– Community Development Block Grant (CDBG) Disaster Recovery Program

Required Permits or Approvals

This project does not require permits, review, or approvals.

Potential Challenges

Municipalities may view the fiscal impact analysis as an additional step in the process of project implementation. While it may lengthen the process slightly, it will ultimately lead to more well thought out and justified decisions.

Case Study | Town of Greece

The annual net fiscal benefit of the shoreline to the Town of Greece is approximately $825,000, before any consideration of flooding costs. In 2017, flooding response costs incurred by the Town amounted to an estimated $975,000, and in 2019, costs were $2.9 million. These recovery costs more than negated the net fiscal benefit generated by the shoreline in those years. However, these properties generate revenue annually while recovery for high-water damage occurs only intermittently. Quantifying costs and benefits in this way can help municipalities make decisions regarding shoreline expenditures.

Basic Info

Location: Lake Bluff Road, Bay Front Lane, and Schnackel Drive in Irondequoit

Site owners: To be determined based on property owner interest

Jurisdiction: Town of Irondequoit

Potential sponsors: Town of Irondequoit

Resiliency Area

Housing

Related Goals

- Safe + Healthy Communities

Complementary Projects

- 12 Regional Buyout Lease-Back Housing Program
- 6 Shoreline Protection in Greece and Irondequoit

Project #11

Mitigate Vulnerable Structures in Irondequoit

Project Description

This project involves engaging with property owners to determine the most appropriate and cost-effective mitigation strategy for their property, including elevation of existing structures, basement floodproofing, and acquisition and demolition or relocation and conversion of the property to open space (also known as a buyout).

Demonstrated Need

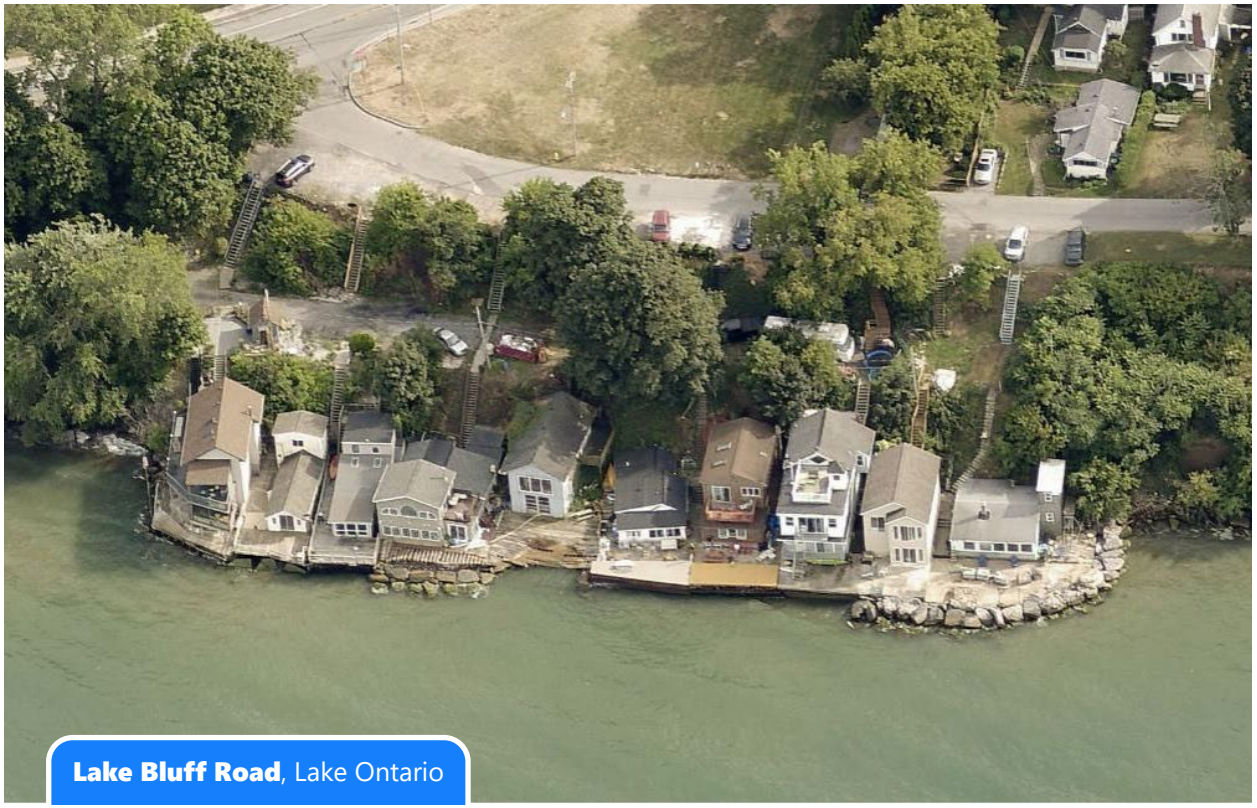
Results from the Risk Assessment showed that the homes on Lake Bluff Road in Irondequoit are at a severe risk to coastal hazards, meaning that property owners are in a dangerous situation, and relocation should be considered a priority. These private single-family residences have frontage directly on to Lake Ontario. Currently, there is very little protection for these properties from flood events, northeast winds, and wave action as the shoreline is developed with private boat docks. According to the United States Army Corps of Engineers (USACE), the shoreline in front of these residences has experienced historical erosion rates of 1.57 feet per year, meaning that the shoreline is naturally retreating 157 feet over 100 years. This is a very high rate of erosion (80th to 90th percentile).[1]

Currently, the only way to access the residences on Bay Front Lane is to park on Schnackel Drive and walk along a walking path to Bay Front Lane. During high water events, the walking path may erode and collapse, forcing residents to evacuate by boat only. Both the Schnackle Cove Homes on Schnackel Drive and the Homes on Bay Front Lane were identified as high risk assets in the Risk Assessment.

Mitigate Vulnerable Structures in Irondequoit

Potential Benefits

Mitigating properties at a high to severe risk to coastal hazards will protect lives and prevent injuries to residents and prevent future property damage to the residences. Elevation and basement floodproofing would reduce exposure to these coastal hazards, while acquisition and demolition or relocation would eliminate exposure entirely. If homes were acquired and demolished or relocated and converted to open space, it would provide an opportunity for the development of additional waterfront park and recreation amenities such as walking trails and bicycle and pedestrian paths. All mitigation measures may also provide environmental benefits by decreasing the impervious surface cover of the lot.



Lake Bluff Road, Lake Ontario

1 USACE (2019). Lake Ontario Natural and Nature Based Feature Opportunities. Retrieved from https://lrb.maps.arcgis.com/apps/MapSeries/index.html?appid=90201bae2b2c410fab28ff2464c251d9

Project #11

Mitigate Vulnerable Structures in Irondequoit

Community Support

This project is supported by and was created in coordination with the Commissioner of Public Works at the Town of Irondequoit. At CLEAR public workshops, community members also suggested home elevation, improved shoreline protection structures, updating residences to meet building codes, floodproofing, and relocation as possible opportunities to address housing risk.

Resilience Relative to Scenarios

This project is focused on preventing damage to life and property during high-water conditions. Assuming higher high water levels in future years, structures that are elevated or floodproofed are anticipated to see fewer or no impacts to human health and safety and less or no property damage from coastal hazards than if structures were not mitigated. Buyouts can also eliminate risks at certain properties entirely.

Implementation

Private property owners may volunteer to mitigate their properties. The Town of Irondequoit should meet with individual property owners to gauge interest and discuss mitigation options and funding.

Timeframe

1 to 2 years[2] | 3 to 5 years | **5+** years[3]

[2] Mitigation measures like floodproofing and elevating could be implemented relatively quickly if property owners are interested.

[3] The buyout portion of this project is not on the immediate horizon but could be considered more earnestly under future climatic conditions.

Estimated Cost[4]

Floodproofing: $10K to $20K
Elevation: $50K to $100K[5]
Buyout: average $350K[6]

[4] Costs are per unit. Total costs for the program would be dependent on the number of property owners interested in mitigating their properties and the chosen mitigation measure.

[5] Elevation and floodproofing costs vary based on the type of technique used (i.e. using piers or pilings, dry floodproofing or wet floodproofing).

[6] Buyout costs would include the cost to acquire the structure, which is usually its fair market value, as well as demolition costs to remove the structure. USACE estimates the average cost of acuqiring and removing one structure at $350,000.

Cost-Benefit Analysis

Mitigating structures prevents property damage, emergency rescues, injuries, and loss of life that would be more likely to result from unmitigated structures.

Schnackel Drive, Irondequoit Bay

During the 2019 high-water events, docks, piers, and yards on Schnackel Drive were flooded.

Project #11

Mitigate Vulnerable Structures in Irondequoit

Potential Funding Sources

The Federal Emergency Management Agency (FEMA) funds acquisition and demolition, property elevation, and floodproofing through their Hazard Mitigation Assistance (HMA) grant programs, including:

- Hazard Mitigation Grant Program (HMGP)
- Flood Mitigation Assistance (FMA)
- Pre-Disaster Mitigation (PDM)
- Building Resilient Infrastructure and Communities (BRIC)

To qualify for FEMA HMA programs, this project must be included in the Monroe County Hazard Mitigation Plan. These funding programs also typically involve a local cost-share of 25% of the total project cost which may include State grant funding and/or municipal funds.

Residential property owners willing to offer their properties for acquisition and demolition may also be eligible for the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) Emergency Watershed Protection - Floodplain Easement (EWPP-FPE) option.

The NYS Climate Smart Communities (CSC) program offers funding and certification points for planning the relocation of vulnerable properties, establishing a buyout program, and the purchase of vulnerable land as part of a strategic relocation project.

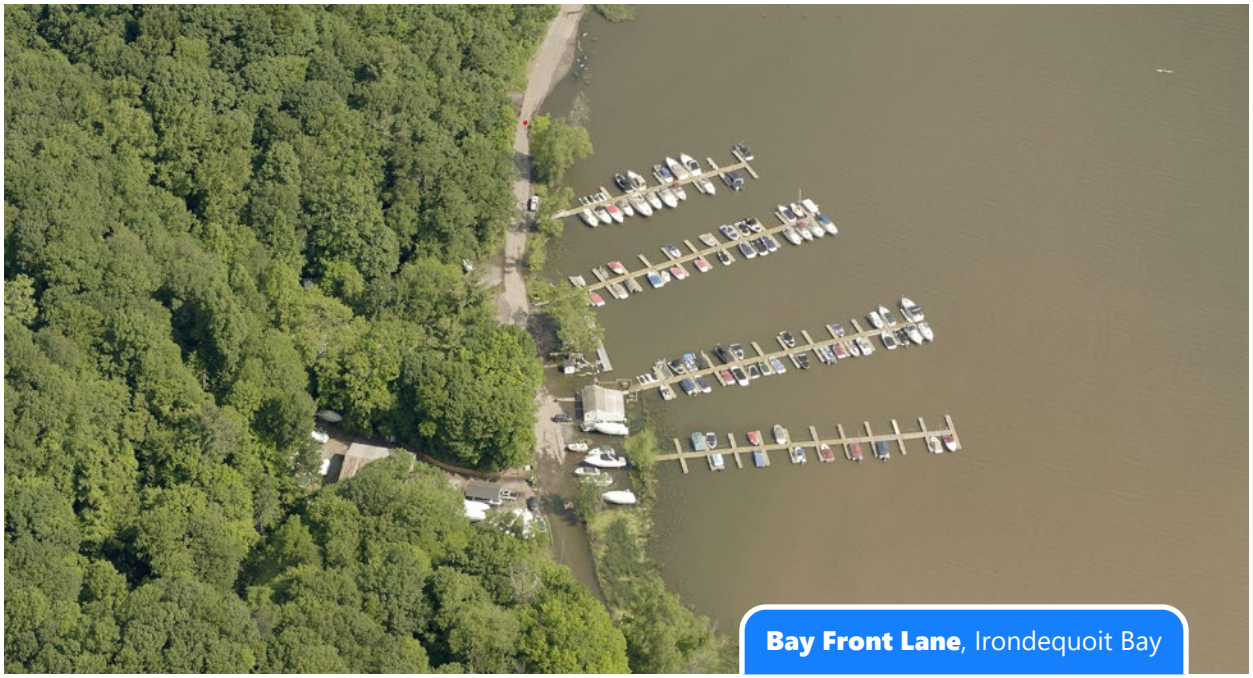
Residential property owners seeking to elevate or floodproof their homes may be eligible for a Irondequoit Home Improvement Program (I.H.I.P.) if they meet eligibility requirements.

Required Permits or Approvals

Applicable environmental permits and regulations are dependent on the location and the nature of the proposed work. Potential permits may include:

- NYSDEC Coastal Erosion Management Permit
- NYSDEC General Permit or Individual Permit for Great Lakes Erosion Control
- NYSDEC Freshwater Wetlands Permit
- NYSDEC Protection of Waters Permit
- NYSDOS Coastal Consistency Concurrence
- Water Quality Certificate
- USACE Nationwide Permit
- USACE permit under Section 404 of the Clean Waters Act

Mitigate Vulnerable Structures in Irondequoit



Bay Front Lane, Irondequoit Bay

Potential Challenges

Residents in vulnerable areas may not be interested in mitigating their properties. A well-developed outreach campaign with multiple options for homeowners may increase the number of residents volunteering to mitigate their properties.

Case Study | Oneida County

In Oneida County, NY, the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) and the Town of Whitestown made $20 million of funding available to acquire residential properties in the Village of Whitesboro in 2020. According to an Oneida County Press Release, NRCS would purchase a floodplain easement and the structure(s) in the easement area at the property of the interested owner, with the Town of Whitestown purchasing the remaining fee title. While the floodplain easement is held by the United States, the Town of Whitestown would become the property owner.[7]

7 Oneida County (2020). Whitesboro Flood Buyout Deadline Approaching. Retrieved from ocgov.net/content/whitesboro-flood-buyout-deadline-approaching

Basic Info

Location: Countywide, focused on high-risk study areas. Exact project locations to be determined during the program design process.

Site owner: To be determined

Jurisdiction: Monroe County

Potential sponsors: Monroe County Economic Development

Potential partners: Land bank, interested municipalities

Resiliency Area

Housing

Related Goals

- Resilient Economy

Complementary Projects

- 1 Local Laws to Increase Resiliency
- 10 Fiscal Impact Analysis for Shoreline Municipalities

Project #12

Regional Buyout
Lease-Back Housing Program

Project Description

This project will seek federal funding for a proactive, managed retreat program for vulnerable residents of high-risk properties. The funding will be used to design an optional risk-reduction program that gives owners of at-risk properties that are highly-likely to be damaged during future flood events an opportunity to sell properties to a public-entity. This program would allow property owners, or others, to rent the home for a short duration, until it is no longer safe to reside in. This allows property owners time to secure safe, alternative housing. Revenue from leasing properties will help to cover the cost of program.

Demonstrated Need

As the frequency of water-level events increases and drives up the public-cost of recovery and mitigation, and the taxable assessed value declines, it may become more financially feasible from a public-cost perspective to buy-out properties instead of continuing to provide services and incur costs related to flooding.

This program is considered an equitable, flexible option because it meets homeowners' current needs for housing before future impacts occur. This flexibility is increasingly important considering the tight housing market in the region, which can make it difficult to find affordable housing options for anyone in the market.

Regional Buyout
Lease-Back Housing Program

Potential Benefits

A buyout program would benefit both homeowners of at-risk properties and municipalities that serve flood-prone areas. Over time, there will be environmental benefits as well.

Homeowner benefits: First and foremost, this program would help residents of flood prone properties reduce their risk to health and safety. Additionally, without such a program, it is likely that homeowners in at-risk areas will find themselves in difficult financial situations as the market value of their properties decline due to increased flooding and perceived risk, while flood insurance costs rise. These homeowners could potentially lose a significant portion of their personal wealth.

Local municipal benefits: It is likely that over time, the costs associated with responding to, rebuilding from, and mitigating repeat flooding of these residential areas can outweigh their net fiscal benefit to the community. A buyout program could alleviate communities of these cost burdens.

Environmental benefits: Over time, areas where the buyout program is successful will be returned to open space, restoring the natural function of the floodplain.

Community Support

Despite their potential benefits, buyout programs are controversial and often misunderstood. Implementation of this program will require a thoughtful community outreach campaign to realign preconceived notions, cultivate understanding, and generate interest in the program.

Resilience Relative to Scenarios

A homeownership buyout program is most appropriate for high-water scenarios where the frequency and severity of flooding continues into the future, putting homeowners and their properties at risk.

Implementation

In order to implement this program, the process of identifying potential funding sources should begin immediately. Once funding is secured, the program can be designed and tailored to the County's needs. County staff could develop regulations of the program and identify potential areas for acquisition in partnership with local municipalities. A robust outreach campaign would need to be implemented in parallel to increase awareness of the program and identify interested homeowners.

Project #12

Regional Buyout Lease-Back Housing Program

Timeframe

1 to 2 years | 3 to 5 years | **5+ years**

Estimated Cost

The cost of this program would vary based on the market value of properties within the program area and the number of homeowners willing to participate. Additional start-up costs would be required to stand up the program and for County staff to seek funding.

For context, the total market value of homes in the floodplain in the Town of Greece is approximately $151 million.

Cost-Benefit Analysis

A Regional Buyout Lease-Back Housing Program is intended to avoid private and municipal expenditures by reducing the number of properties in the floodplain. Expenditures made to acquire properties are expected to be recaptured in the cost savings from prevented property damage. In Charlotte-Meckelnburg County, North Carolina, for instance, the $67 million used to acquire properties has resulted in an estimated $25 million in cost savings from storm events that have happened to date. An additional $300 million in costs savings is expected from future storms. (See **case study** at right.)

The lease-back element of the program also provides an opportunity to recapture acquisition costs. Likewise, the reclamation of land as open space will provide ecosystem services and additional opportunities for recreation and tourism.

Required Permits or Approvals

Not applicable for this type of project.

Potential Funding Sources

- Community Development Block Grant Disaster Recovery Buyout Program
- Flood Mitigation Assistance Program (FEMA)
- Hazard Mitigation Grant Program (FEMA)
- Building Resilient Infrastructure and Communities Program (FEMA)

Potential Challenges

The largest challenge to implement this program will be encouraging homeowners to participate. A robust public awareness campaign will be necessary to promote the benefits of the program and identify willing homeowners. The program may also be politically unfavorable for local officials to push through.

Case Study | Floodplain Buyout Program

Charlotte-Mecklenburg County, North Carolina

Description

Charlotte-Mecklenburg Storm Water Services (CMSS) — a county-wide regional utility in North Carolina — administers a Floodplain Buyout Program to relocate vulnerable residents out of floodplains and reduce long-term flood damage. Once bought out, properties are returned to open space uses to restore their natural beneficial flood retention and water quality improvement functions and provide other community amenities, like parks and trails.

CMSS has purchased more than 400 flood-prone homes and businesses and enabled over 700 families and businesses to relocate to less vulnerable locations outside of the floodplain. CMSS has also supported a number of lease-back arrangements on a case-by-case basis with property owners to increase participation in the buyout program and reduce the county's property maintenance costs.

As a result of the floodplain buyouts, the community has gained an additional 185 acres in open space and recreational assets and encouraged the development of newer, more resilient buildings in less vulnerable locations within Mecklenburg County.

The program has been funded through a combination of federal and local government sources, with lease-backs also supporting the recapture of some costs. CMSS has invested more than $67 million to acquire flooded properties. As a result, the county estimates it has avoided an estimated $25 million in property damage and related losses to date, and prevented $300 million in future losses.

Other local governments could consider adopting a comprehensive buyout program like Charlotte-Mecklenburg's or individual program elements, like local funding options or leasebacks, to help support voluntary retreat decisions in coastal areas experiencing water-level fluctuations, impacts from disaster events, and land loss.

Fast Stats

400 flood-prone homes and businesses purchased

700 families and businesses relocated out of floodplain

185 acres of land reclaimed as open space

$67 million — cost to acquire properties

$25 million — estimated cost savings from property damage and losses experienced to date

$300 million — projected cost savings for damage related to future storm and water events

Basic Info

Location: Coastal bluffs and beaches in Monroe County

Site owners: To be determined based on site selection

Jurisdiction: To be determined based on site selection

Potential sponsors: University partners, public and NGO partners, consulting firm

Potential partners: USACE, NYSG, interested municipalities

Resiliency Area

Natural + Cultural Resources

Related Goals

- Design with Nature

Complementary Projects

- 19 Hamlin Beach State Park Resiliency Master Plan
- 16 Durand Eastman Beach Resiliency + Access Plan
- WAYNE CLEAR Wayne County CLEAR Drumlin System

Project #13

Coastal Bluff + Beach Protection

Project Description

Bluffs and beaches are key features of coastal resilience, buffering property and infrastructure from wave action and storms and providing vital habitat for migrating waterfowl and littoral vegetation. Understanding the processes that form and maintain these beaches, and identifying the sources of the raw material – sand, gravel, and cobbles – that shape these natural habitats are key ingredients in a plan for coastal resilience. Recent coastline research has clarified how riprap, breakwalls, and other engineered structures deplete the supply of sediment for beaches and shorelines and remove habitat. This project will focus on identifying features that should remain in an unarmored natural state to ensure a continued supply of the raw material that forms the shoreline.

Demonstrated Need

A critical component of an overall coastal resiliency strategy is the effective management of shorelines and nearshore sediments. This is especially important in the Great Lakes, which are exhibiting a deficiency of sand and cobble resources directly attributed to increased coastal development and shoreline armoring. For example, because of shoreline armoring the nearshore sand supply in Lake Ontario is estimated to be less than half what it was before shore development began in the 1800s.[1] Naturally occurring erosion is vital for the creation of new sand and gravel which ultimately supplies nearshore environments. Trends towards increasing shore protection indicate the future will bring further loss of sand supply, eventually leading

1 Baird, 2011

2 Selegean, 2021

Coastal Bluff + Beach Protection

to the disappearance of beaches, increased bluff recession, and changes to nearshore habitat.[2] These beach, dune, and bluffs are natural protective features, which not only contribute to coastal resiliency of public infrastructure and private properties, but also provide important fish and wildlife habitat, and recreational opportunities. For this reason, the importance of identifying, preserving, and restoring natural sediment supply to New York's Great Lakes coastline cannot be overstated.

The rapid pace of shoreline armoring in recent years shows no signs of slowing. One recent assessment classified the Lake Ontario shoreline as >40% hardened, a significant increase over the previous assessment (2009).[3] This trend, coupled with a general lack of public knowledge regarding the importance of sediment supply to coastal health, and the historic absence of a natural protective feature preservation focus in resiliency planning, demonstrate this project is needed.

In addition, coastal features such as barrier beaches and bars are important to the resilience of inland bays such as Braddock, Irondequoit, Sodus and Fair Haven; but need a continuing source of sand, gravel and cobbles to maintain their physical integrity.

Potential Benefits

Identification and detailed characterization of specific key sediment-contributing "feeder" shoreline areas, nearshore sand formations, and transport/connectivity of littoral material can be used to provide public and private land managers with a heightened awareness of the importance of sediment supply to coastal resilience, including actionable information related to preservation, protection, and restoration of these coastal features. This information can have a direct benefit to coastal community resilience, and recreational and ecosystem co-benefits.

Community Support

The sandy and cobble beaches of Monroe and neighboring counties are some of the most popular and visited features of the Lake Ontario coast. Hamlin Beach State Park and the sandy shorelines of Braddock Bay WMA attract thousands of visitors. Protecting natural features at these destinations will ensure that they can be continued to be used by community members into the future.

3 Draft SOGL Hardened Shorelines Indicator Report, 2021

Project #13

Coastal Bluff + Beach Protection

Resilience Relative to Scenarios

Natural protective features with sufficient sediment supply are inherently resilient to changing water levels.

High-water conditions: During high water conditions, material is added to the system. Areas not subject to high-risk development should be allowed to erode.

Low-water conditions: During low water conditions, beaches are rebuilt – but only if sediment supply is sufficient, which this project looks to address.

Implementation

The sediment budget for the southern shore of Lake Ontario, recently developed and released by the USACE Buffalo District, provides an important model for how sand and gravel are activated, moved, and deposited along the shoreline of the lake. All too often, basic and essential processes like the west-east longshore current of coarse sediment are poorly understood and ignored. The huge sand deposit at the "Devil's Nose" in Hamlin Beach State Park is a potential example of such a source of sediment. The USACE sediment budget indicates that the 1-kilometer cell that contains this feature makes an important contribution to the longshore movement of raw material for the shoreline.

This project will build upon the information provided by the USACE model to identify specific sources of coarse sediment, quantify the contribution of sand and gravel from these sources, and clarify the role of these key sources in the dynamics of the shoreline. An array of geophysical methods will be employed, benefiting from similar research in coastal areas like Puget Sound in Washington. As the design and methods of this project are finalized, guidance will be sought from scientists at the USACE Buffalo District, other public agencies, and coastal geologists at regional universities.

Also importantly, this project must be considered in the context of the larger system. Similar efforts are being pursued in adjacent CLEAR regions, through the Wayne County drumlin system as an example.

Timeframe

1 to 2 years | 3 to 5 years | 5+ years

Estimated Cost

$500,000 to $750,000

Coastal Bluff + Beach Protection

Cost-Benefit Analysis

Making the effort to preserve and protect natural features now is more cost-effective than trying to rebuild and replenish these natural systems after they have been diminished. Taking protective steps now can avoid much more costly projects in the future.

Required Permits or Approvals

To be determined.

Potential Funding Sources

This project could be funded through the Consolidated Funding application (CFA), GLRI, and other public sources of support. There may be other opportunities for cooperative funding for this project through the USACE in partnership with local sources.

Case Study | Lake County Ohio

A similar project in Lake County Ohio involving a detailed study of Lake Erie bluffs was used to support the acquisition of coastal parcels that became the Lake Erie Bluffs Preserve Metropark, which now protects dozens of rare plant and animal species and offers hiking, kayaking, fishing, and bird-watching opportunities. Also protected are 9,000 feet of undeveloped Lake Erie shoreline, allowing for natural bluff erosion and a sand source important to ecosystem health.

The Ohio Sand Study is also providing additional support for the Ohio Department of Natural Resources to base regulatory decisions (in part) on the potential impact of activities on coastal sand resources. Projects that trap sand will have mandatory sand monitoring and bypass provisions as part of the shore structure permit. Projects will not be authorized without sand monitoring and bypass provisions.[4]

4 Mackey, 2016

Basic Info

Location: Rochester Embayment Area of Concern

Site owners: Braddock Bay is managed by NYSDEC; Lake Ontario is managed by the International Joint Commission

Jurisdiction: NYSDEC

Potential sponsors: USACE

Potential partners: Towns of Greece, Irondequoit, Parma, and Webster, City of Rochester, NYSDEC, NYSG

Resiliency Area

Natural + Cultural Resources

Related Goals

- Responsible Neighbors

Complementary Projects

- 2 Shoreline Data Needs Planning Study
- 7 Near-Shore Wave Energy Attenuation System
- USACE Braddock Bay Ecosystem Restoration Project

Project #14

Regional Modeling in the Rochester Embayment

Project Description

This project expands the U.S. Army Corps of Engineers (USACE) Research and Development Center's "Modeling of Waves, Hydrodynamics, and Sediment Transport for Protection of Wetlands at Braddock Bay, New York" study to encompass the entire Rochester Embayment as a preparatory step to better inform the design of offshore structures.[1]

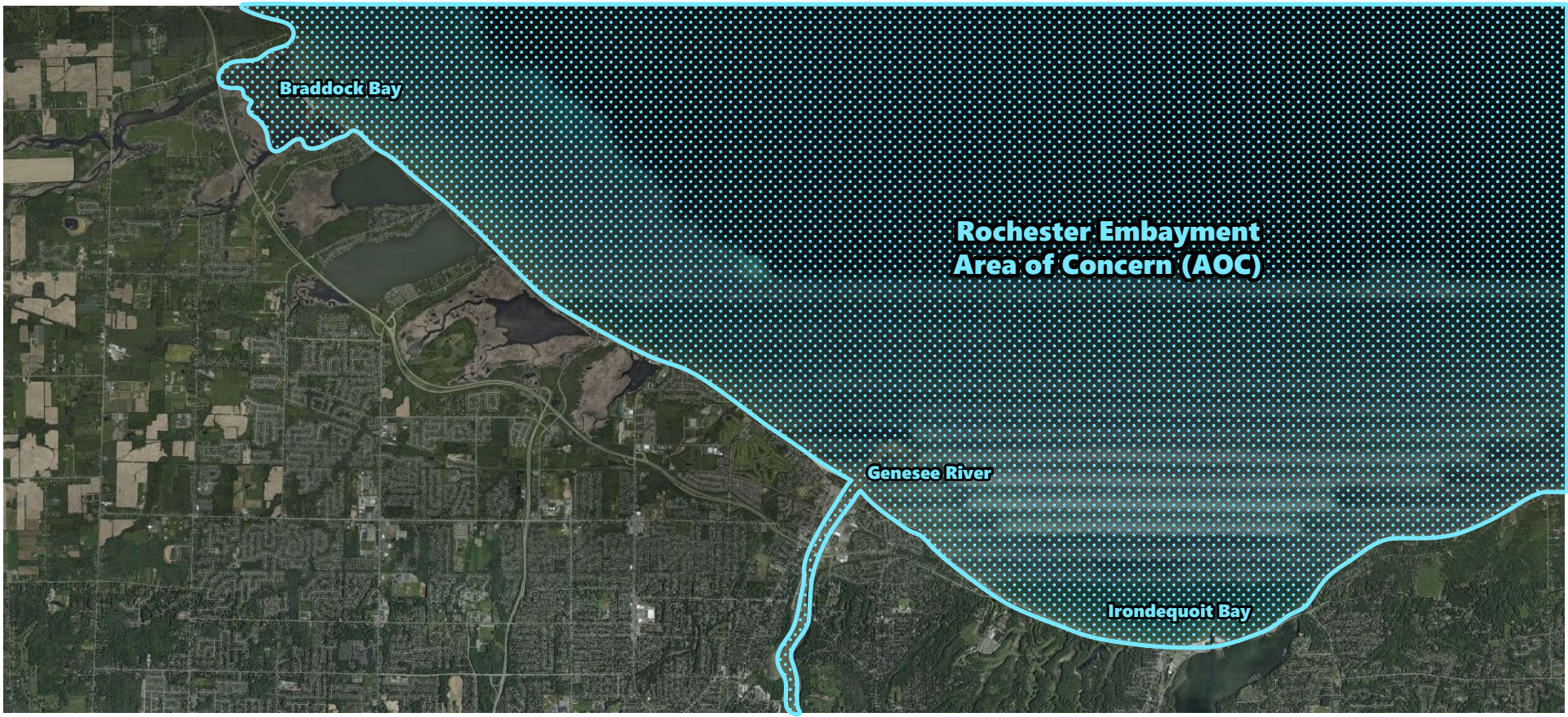
Demonstrated Need

Assets along the entire shoreline of the Rochester Embayment are at risk of wave action, erosion, and flooding during high water events. A better understanding of extreme waves, water levels, and longshore and cross-shore sediment transport along the Lake Ontario shoreline is needed to inform the design of shoreline protection measures.

In Braddock Bay, the dredged channel has regularly silted in over time, making it difficult for deeper draft vessels to enter, and the bay's emergent marsh has eroded due to the loss of the barrier beaches and other landforms that previously protected the bay from wave energy.

To mitigate this issue, the EPA funded the construction of a 1,600-foot barrier beach structure to protect the entrance to the bay, but sedimentation still occurs. According to staff in the Town of Greece, soil was dislodged during the 2017 and 2019 high-water events, and the navigation channel filled in quickly. Even after dredging performed as part of REDI, the navigation channel continues to be silted in. This creates an ongoing need for dredging in Braddock Bay.

Regional Modeling in the Rochester Embayment



1 US Army Corps of Engineers (USACE) (2015). Modeling of Waves, Hydrodynamics, and Sediment Transport for Protection of Wetlands at Braddock Bay, New York. Retrieved from https://usace.contentdm.oclc.org/digital/collection/p266001coll1/id/3862/

Project #14

Regional Modeling in the Rochester Embayment

Potential Benefits

Sediment management in the Rochester Embayment will inform the design of shoreline protection structures that will protect human health and safety and prevent future property damage along the shoreline. Additionally, these can potentially enable recreation through beach growth and protection.

Modeling can optimize costs by helping to lower planning and design costs of shoreline protection structures. Shoreline protection will also allow for the continued use and enjoyment of recreational and cultural assets along the shoreline. A greater understanding of waves, hydrodynamics, and sediment transport will also inform beach and habitat restoration in the Rochester Embayment Area of Concern and associated New York State Department of Environmental Conservation Significant Coastal Fish and Wildlife Habitats.

Braddock Bay Ecosystem Restoration Project
USACE + US EPA, Completed 2020

Community Support

This project was developed in coordination with the Director of Development Services, Planner, and Town Engineer from the Town of Greece and the Commissioner of Public Works at Town of Irondequoit.

Regional Modeling in the Rochester Embayment

Resilience Relative to Scenarios

Modeling of waves, hydrodynamics, and sediment transport will inform shoreline protection decisions for both high-water conditions and low-water conditions.

Implementation

Modeling would most likely be performed through a partnership with the USACE. Results will then be used to inform the planning and design of coastal resilience strategies.

Timeframe

1 to 2 years | 3 to 5 years | 5+ years

Estimated Cost[2]

$250,000

[2] Estimate based on costs for similar projects.

Cost-Benefit Analysis

This will be a beneficial investment as this modeling framework can be used to optimize the design of coastal structures, save costs, and lend itself for application towards the development of a real time forecasting system.

Potential Funding Sources

Engineering design and feasibility studies are eligible for funding through the Federal Emergency Management Agency (FEMA) Building Resilient Infrastructure and Communities (BRIC) program as a "project scoping" activity. Funding for the implementation of shoreline protection projects are also eligible for FEMA Hazard Mitigation Assistance (HMA) grant programs. To qualify for FEMA HMA funding, this project must be included in the Monroe County Hazard Mitigation Plan. These funding programs also typically involve a local cost-share of 25% of the total project cost which may include State grant funding and/or municipal funds.

Nationally-competitive funding for coastal resilience projects are also available from the National Fish and Wildlife Foundation (NFWF).

Funding is also available through a partnership with the USACE.

Required Permits or Approvals

Modeling efforts do not require permits, review, or approvals to implement.

Potential Challenges

This effort is predicated on availability of observation data of waves, water levels, and sediment transport. This would be required for model calibration. There might be a need to undertake a field data campaign based on a gap analysis.

Basic Info

Location: DEC Fishing Access site at St. Paul Terminus

Site owners: City of Rochester, NYSDEC

Jurisdiction: City of Rochester

Potential sponsors: City of Rochester, NYSDEC

Resiliency Area

Natural + Cultural Resources

Related Goals

- Design with Nature

Complementary Projects

- REDI: Fishing Access at St. Paul
- 14: Regional Modeling in the Rochester Embayment

Project #15

DEC Fishing Access
Elevation + Enhancements

Project Description

This project addresses the need to modify an existing publicly accessible DEC fishing site along the Genesee River by raising infrastructure above anticipated current and future flood levels. The project follows-on and enhances an existing REDI project (REDI MO-09) which focused on adapting nearby parking, roads, and stormwater infrastructure to high-water conditions. Beyond adapting the fishing site to future varied and high-water scenarios, the project serves a vulnerable population and will result in improved user amenities, potential in-water habitat enhancements, and cultural enrichments focused on resiliency education and public art.

Demonstrated Need

In 2017 and 2019, the fishing site walkway and nearby parking and road infrastructure was flooded (see image at right), resulting in loss of service of the fishing facility for extended periods of time. The Risk Assessment conducted as part of this CLEAR Plan identified portions of this site as at high and extreme risk to future flooding.

An in-progress REDI project for the site, focuses on adapting nearby parking, roads, and stormwater infrastructure to high-water conditions. Fishing site improvements would make the fishing area itself more resilient to changes in water level, less vulnerable to flooding, and ensure its continued use for recreation.

Existing Conditions

The DEC Fishing Site at St. Paul Terminus is a well-used recreational asset that serves vulnerable populations by providing public waterfront fishing opportunities on the east side of the Genesee River. The site consists of an approximately 380-foot-long concrete-paved promenade, parking lot, landscaping, river railing and knee walls, with regulatory and interpretive signage.

Project #15

DEC Fishing Access
Elevation + Enhancements

Potential Benefits

Elevating and enhancing the fishing area at the DEC site would reduce exposure and vulnerability, provide efficient and speedy recovery from hazard events, and provide an enhanced accessible recreational opportunity for vulnerable populations. No other publicly accessible riverfront areas are located on the eastern side of the Genesee River near the port and Lake Ontario. The enhancement and improvement of this site provides enhanced waterfront access opportunities. Beyond adapting the fishing site to future high-water scenarios, the project serves a vulnerable population and will result in improved user amenities, potential in-water habitat enhancements, and cultural enrichments focused on resiliency education and public art.

Community Support

This project directly supports the top identified community needs, including mitigating future flood damage to parks, piers, and boardwalks, protecting vulnerable populations, and enhancing public access to fishing and other waterfront activities. DEC and the City of Rochester consider the project critical to support fishing access for vulnerable populations. The project is also identified as a high priority project by the DEC as a future phase to an existing Lake Ontario REDI project (REDI MO-09).

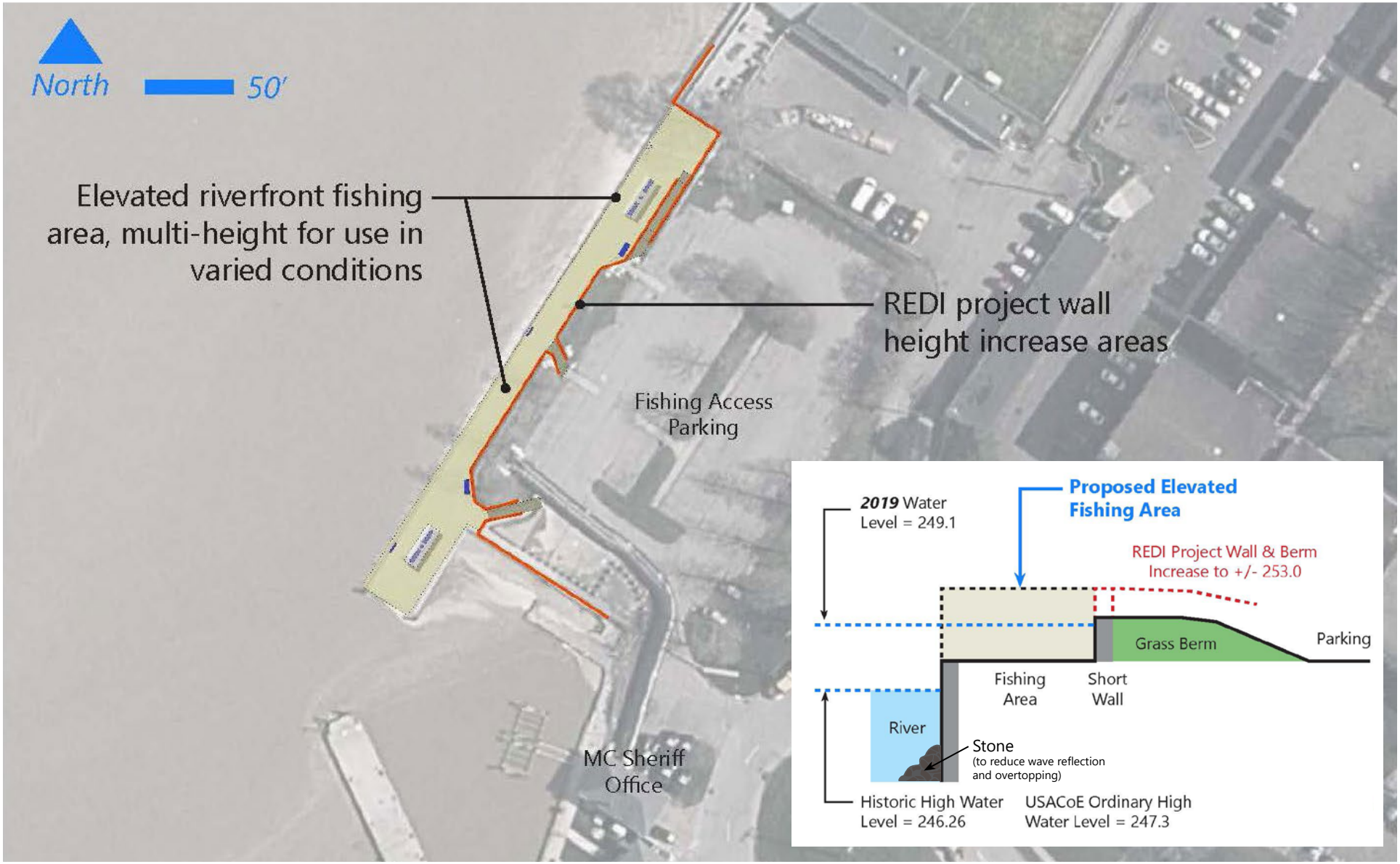
Resilience Relative to Scenarios

The project generally focuses on elevating infrastructure, which reduces the damage caused by flooding if raised above flood levels. However, elevating the fishing site area does not adapt well to low water scenarios. A design should adapt to varied water levels, including low-water conditions, by providing a fishing area with multiple varied height boardwalks or platforms to fish from.

Implementation

The scope of the project would include advanced feasibility and conceptual studies, preliminary and detailed design of an elevated riverfront fishing area (to replace existing) that will not flood during seasonal or future high-water conditions. The elevated fishing area should be multi-height to serve varying water level conditions and maximize functionality. Inclusion of site amenities that facilitate fishing activities are also proposed, including seating, shade structures, and other public realm amenities. Though useful, fish cleaning stations may not be feasible at this site due to utility needs. The project intent is to serve fishing needs at this regulated Part 59 Fishing Access Site. Therefore,

Conceptual Plan



Project #15

DEC Fishing Access
Elevation + Enhancements

there may be limitations on new amenities that do not directly support fishing activities.

Design phase engineering should be completed in the short timeframe (1 to 2 years). Construction and implementation could be completed within 3 to 5 years. However, factors such as permitting and the timing and phasing of the existing REDI project may factor.

The on-site REDI project is currently in design and will address flooding at this location through a combination of berms and parking lot-side wall height increases which provide benefit to nearby businesses, wastewater infrastructure, adjacent emergency and coast guard facility access. The final design of the REDI project will ultimately inform the need for and design of this project.

Timeframe

1 to 2 years | **3 to 5 years** | 5+ years

Estimated Cost[1]

$500,000 to $1,000,000

[1] The project cost includes approximately $370,000 for floodwall extension and modifications and $240,000 for fortification by berm structure. The estimates include construction costs, engineering design fees, and contingency for a bare bones approach to mitigating floodwater impacts and are not based on a detailed design. It is anticipated that a facility that considers accessibility and public amenities along with resiliency and infrastructure elevation would require added funding.

Cost-Benefit Analysis

The project cost is an investment in the State and City-owned public recreational resource that serves a vulnerable and generally lower income population. Fishing is a common and popular recreational activity that requires publicly accessible shorelines. An elevated fishing site area ensures continued function of the site, protects life, health and property, and also potentially reduces municipal or other governmental costs associated with recovering from high-water flooding events.

Potential Funding Sources

Funding for this project could come from a variety of State sources including the LWRP, EPF, and WQIP streams through the CFA as well as from the GIGP. Funds may also be available from the Great Lakes Restoration Initiative.

DEC Fishing Access
Elevation + Enhancements

Required Permits or Approvals

The project will require multi-jurisdictional review and permitting, including but not limited to:

- US Army Corps of Engineers, Federal Waters / Wetlands Permit
- US Fish and Wildlife Services, Threatened and Endangered Species Act Compliance Consultation
- NYS-Department of Environmental Conservation, Coastal Erosion Hazard Area Permit, Freshwater Wetlands Permit, Article 15 Protection of Waters Permit, Water Quality Certificate, State Environmental Quality Review Act (SEQRA), and SPDES General Permit for Stormwater Discharges from Construction Activity
- NYS-Department of State, Federal and State Coastal Consistency Review
- City of Rochester, Site Plan review, Consistency with Zoning and Local Waterfront Revitalization Plan, Floodplain Development Permit
- Monroe County Division of Pure Waters, Sanitary Storm Sewer Permitting and Plan Approval

Additional review and permits may be required beyond those noted. The permits would generally be acquired through a Joint Application Form (JAF).

Potential Challenges

The primary challenges to the project are lack of current funding and the difficulty in developing a plan for the fishing area that is adaptable to low water conditions. The strategy of elevating the fishing platform should potentially be combined with creative ways to provide lower fishing platforms designed to flood during high-water events while the upper areas remain in service for users.

Other challenges to overcome include the structural and regulatory complexity of the sheet piling river wall and performing work in water, potential threatened and endangered species such as freshwater mussels, and the unified coordination of design with the REDI project that is already underway. Early coordination with stakeholders and agencies may identify key additional regulatory needs or design parameters, including the process and timetable required for surveying and relocating threatened species.

Basic Info

Location: Durand Eastman Beach, Rochester

Site owners: City of Rochester, NYS

Jurisdiction: City of Rochester, NYS

Potential sponsors: City of Rochester

Resiliency Area

Natural + Cultural Resources

Related Goals

- Design with Nature

Complementary Projects

- 14 Regional Modeling in the Rochester Embayment
- 13 Coastal Bluff and Beach Protection
- 5 Porous Pavement Impervious Surface Reduciton

Project #16

Durand Eastman Beach
Resiliency + Access Plan

Project Description

This project addresses the need to update an existing 2007 park master plan to identify, prioritize, and phase the implementation of various resiliency and adaptation strategies at Durand Eastman Beach over time. Implementing strategies developed within a Durand Eastman Beach Resiliency, Access, and Green Infrastructure Plan would ultimately increase the public beachfront site's resilience to changes in water levels, formalize and enhance user access to the beachfront, and reduce the volume, environmental quality, and erosion impacts of significant parking lot runoff.

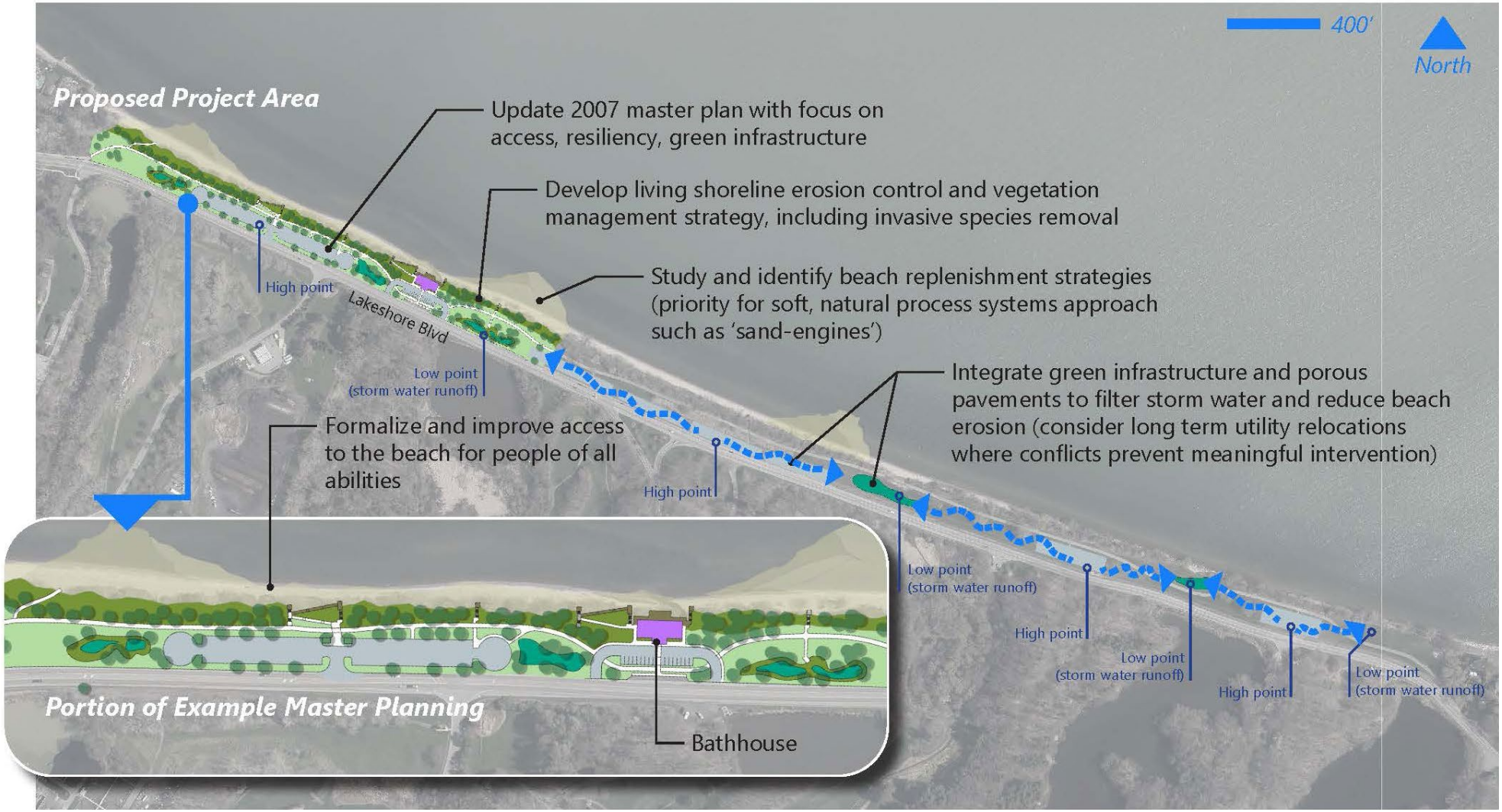
Demonstrated Need

The site has a history of swimming closures which have historically been due to water quality concerns (predominantly bacterial / e.coli and stormwater discharges). However, more recently closures have been directly tied to high-water events in 2017 and 2019 that required beach closure for extended periods. The loss of beach also limits capacity of the recreational resource, reducing public access to the Lake Ontario shoreline. The beach is expected to be at high risk to flooding in the future according to the Risk Assessment.

Potential Benefits

An updated master plan and implementation of the resulting phased plan initiatives would reduce exposure and vulnerability. Using up-to-date site inventory and analysis, broader data on sediment and beach front replenishment, and detailed studies on stormwater treatment options and

Conceptual Plan



Project #16

Durand Eastman Beach
Resiliency + Access Plan

beach access opportunities, the plan would identify appropriate strategies to moderate the effects of high-water events and increase the ability for the beach to recover from hazards.

The plan would provide needed long-term coordination between various facilities enhancements, management processes, and recreational programming opportunities. It would provide a roadmap of comprehensive strategies to align coastal resiliency and environmental quality needs with facilities, user amenities, parking and recreational features, vegetation and bluff management, more sustainable stormwater management, erosion control, long-term beach replenishment, and the development of safe accessible routes to the beachfront.

Economic and cultural benefits are also significant, with the beach providing recreation and leisure opportunities for more than 130,000 visitors annually.

Community Support

The project has very high support based on community engagement and feedback received during the CLEAR plan development, ranking as the top priority project at Public Workshop #3.

The project is also consistent with the goals of the City of Rochester's 2034 Comprehensive Plan and Local Waterfront Revitalization Program.

Resilience Relative to Scenarios

The project will identify the most adaptable resiliency strategies for the beachfront and upland areas, including anticipating performance in both high and low water scenarios. Generally, it is expected that implementation of the plan's initiatives will allow the beach to remain open under many high-water conditions. Future sediment and beach replenishment strategies may allow sustained use of the public beach in the long-term. Green infrastructure and stormwater management will also reduce the likelihood of a loss of service during significant precipitation events in the short-term. However, the narrow characteristics of the beach and bluff hemmed in by Lakeshore Boulevard may potentially limit the ability to prevent loss of service in the most extreme high-water scenarios.

Low-water scenarios are not expected to cause loss of service since the beach capacity increases significantly during low water conditions.

Timeframe

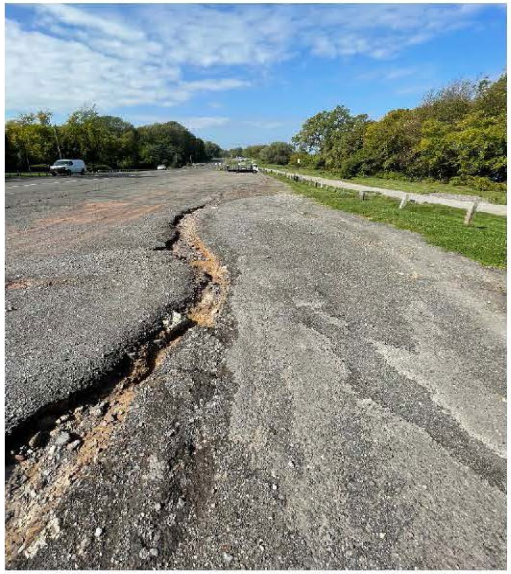
1 to 2 years | 3 to 5 years | 5+ years

Existing Conditions

Beach in 2019

Trail pavement undermining

Poor access & erosion



Parking lot erosion

Beach in dry season (2021)

Parking lot drainage to lake

Project #16

Durand Eastman Beach
Resiliency + Access Plan

Implementation

Updating the 2007 master plan for Durand Eastman Beach should be completed in a short (1-2 years) timeframe to coordinate and align closely with the planned beach house facilities. Planning for select phased green infrastructure and beach access improvements should also coincide with the development of this significant beach facility and associated parking, trail, and stormwater/utilities modifications in the short timeframe (1-2 years). Additional plan-identified green infrastructure and access improvements may be phased in over time in the medium (3-5 years) and long (5+ years) timeframes based on funding availability. Planning and implementing significant projects addressing beach sediment replenishment are long timeframe (5+ years) efforts, requiring complex coastal hydrological engineering assessment and a willingness to potentially develop smaller proof-of-concept projects to evaluate performance prior to full implementation.

Estimated Cost[1]

$150,000 to $200,000

[1] This includes professional service and technical / lab fees for a consultant team with appropriate multidisciplinary experience with resiliency, environmental investigations and permitting, stormwater and green infrastructure, coastal hydrology, landscape architecture, ecosystem and wetland planning and design engineering, park and recreational master planning, and historic preservation. A detailed scope of services should be developed by the City of Rochester prior to finalizing the project budget. Construction costs and an implementation budget for phased resiliency interventions identified within the master plan would be prepared and prioritized during the planning process.

Cost-Benefit Analysis

The project cost is an investment in the popular public recreational resource that will facilitate planning and implementation of resilient systems based on natural processes. The resulting reduction in exposure and vulnerability from implementation of the updated master plan will preserve beachfront recreational opportunities and yield high returns in economic, recreational, and tourism activity in the region.

Potential Funding Sources

Funding for this project could come from a variety of State sources including the LWRP, EPF, and WQIP streams through the CFA as well as from the GIGP. Funds may also be available from the Great Lakes Restoration Initiative.

Durand Eastman Beach
Resiliency + Access Plan

Required Permits or Approvals

No permit requirements are anticipated for planning projects. Future implementation of capital projects identified within the master plan would require multi-jurisdictional permit review, including review by the U.S. Army Corps of Engineers and New York State Department of Environmental Conservation, among others.

Potential Challenges

Several challenges are expected in the implementation of both the master plan project and future capital improvements projects. Immediate challenges include the lack of identified funding for the updated master plan (and implementation) and the need to closely coordinate with the imminent short-to-medium timeframe implementation of the City's beach house project.

Substantial underground utilities exist within some areas identified as conceptual green infrastructure locations. These should be evaluated during the planning effort to understand feasibility of green infrastructure implementation.

The extensive regional scope, complexity, and scale of potential natural systems-based beach and sediment replenishment efforts could prove to be a technical, political, and economic obstacle. This portion of the project may benefit from being initially implemented as a pilot project to study the proposed techniques before wide-scale implementation.

Permitting challenges may also exist with the implementation of any shoreline or in-water work.

Public Bath House Project

The City of Rochester is currently in the process of contracting out services to design a public bath house at Durand Eastman Beach as identified in the 2007 Master Plan. The beach house will include restrooms, changing rooms, a lifeguard office and first aid station, storage, exterior deck areas, and safe beach egress. The project is funded, in part, by the NYSDOS Local Waterfront Revitalization Program (LWRP).

Several other projects are ongoing at and nearby the site including: trail maintenance, management, and improvements to the multi-use trail, and nearby utility and drainage projects that impact the flow of stormwater to the lake.

Basic Info

Location: Ellison Park, Penfield

Site owners: Monroe County

Jurisdiction: Monroe County, Town of Penfield, NYS-OPRHP

Potential sponsors:
Monroe County Department of Parks

Resiliency Area

Natural + Cultural Resources

Related Goals

- Design with Nature

Complementary Projects

- 5 Porous Pavement Impervious Surface Reduction

Project #17

Ellison Park
Resiliency Master Plan

Project Description

This project addresses the need to strategically master plan for the future funding, design, and implementation of various resiliency and adaptation strategies within Ellison Park over time. The resulting Ellison Park Resiliency Master Plan would ultimately identify and phase a variety of short, medium, and long-term capital project initiatives focused on improving resiliency to changes in water levels and flooding and which support swift and effective recovery from these events.

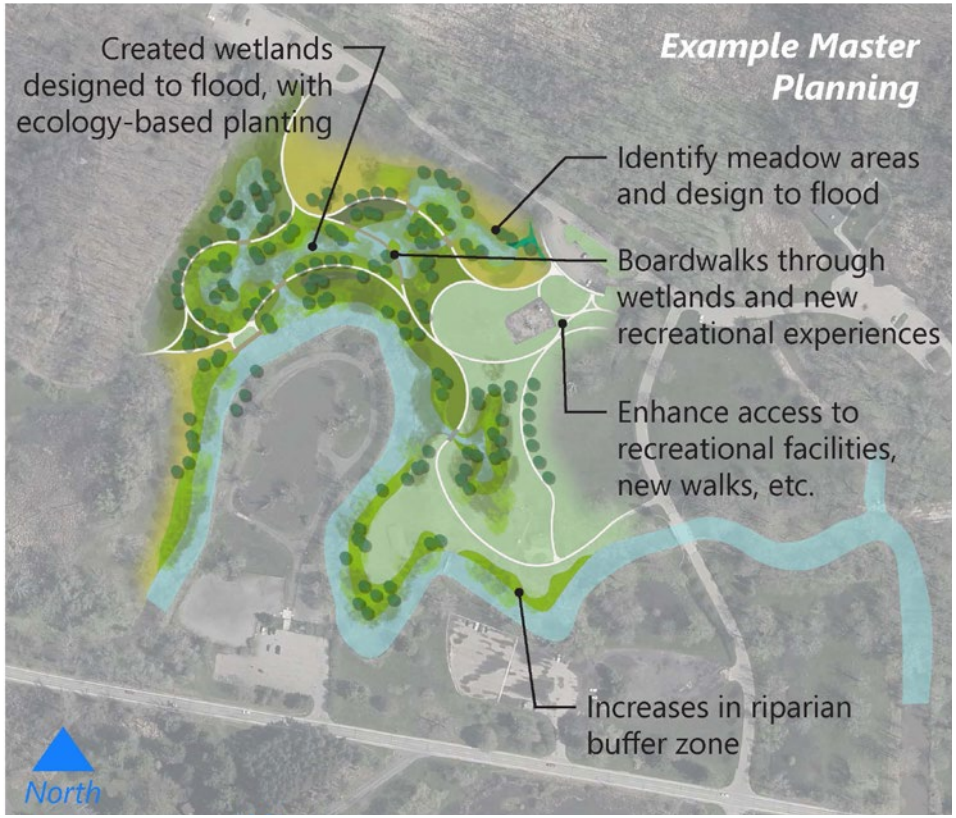
Demonstrated Need

The low lying areas of Ellison Park have a direct relationship with Irondequoit Creek where current park landforms and the arrangement of facilities are influenced by the meanders and oxbows of the creek. Likewise, the entirety of the lowland areas within the park are within regulatory floodways or the SFHA. Flooding is a consistent, frequent, and recurring problem within the park that requires closure of facilities during and after precipitation events and increases maintenance costs for cleanup and recovery. Expansive lawn fields in some areas of the park are unusable for recreational purposes for extended periods after relatively minor rain events. Several structures, recreational facilities, roads, and other park assets are located within the regulatory floodway and experience occasional flooding and closures.

Ellison Park
Resiliency Master Plan

Example Plan

Existing conditions and aerial photo of northern area of Ellison Park. Indiciated areas observed to be consistently wet 4 to 5 days after modest rain events.



Example natural systems-based planning and design concept for the northern portion of Ellison Park.

Project #17

Ellison Park Resiliency Master Plan

Demonstrated Need CONTINUED

Risk mapping indicates that park infrastructure within Irondequoit Creek lowland areas through much of the park, including numerous recreational facilities and structures, are at potential extreme risk from flood events. While it is strategically advantageous for a park to flood rather than a neighborhood of housing or businesses, a range of nature-based resiliency systems are needed within the park to reduce vulnerability and exposure to these flood events. These include infrastructure relocation, preservation and enhancement of open space, wetland creation, green infrastructure improvements, increasing the riparian vegetative buffer to Irondequoit Creek, the development of living shorelines, and potential elevation of existing infrastructure.

Potential Benefits

The master plan and resulting phased resiliency initiatives would reduce exposure and vulnerability. Using up-to-date site inventory and analysis, the master plan would identify appropriate practices and strategies to moderate the effects of flood hazards or other conditions and increase the ability for the park to recover from hazard conditions. Benefits of the planning effort may include sustaining and enhancing public access to existing recreational assets or providing new types of recreational opportunities, reducing impervious surface area within sensitive riparian zones, and preserving ecological health of the creek corridor and nearby marshes and wetlands. By promoting the most adaptable resiliency strategies and prioritizing designing with natural processes, the project would also include several co-benefits. These include increased biodiversity, ecosystem services, and increased public health. Economic benefits resulting from making Ellison Park more resilient include economic activity from tourism and recreation and increased nearby property values.

About the Park

Ellison Park is a diverse landscape of woodlands, steep ravines, and lowland river bottoms along Irondequoit Creek. The park sits at the transitional zone between Irondequoit Bay and the creek and wetlands located within the broad river bottom. The park supports a wide variety of sports and nature-based recreational activities, trails, lodges, pavilions, playgrounds, and water-based activities (kayaking, canoeing, and fishing). The park includes 447 acres, dispersed across the lower creek lands and ravined slopes.

Existing Conditions

Narrow riparian buffers along creek

Lawn fields frequently unusable due to wet conditions

Facilities remain impacted by water several days after rain events

Frequent flood events (D&C)

Project #17

Ellison Park
Resiliency Master Plan

Potential Benefits CONTINUED

The preparation of an Ellison Park Resiliency Master Plan would engage the community and use the inherent qualities of the park to reposition it as an ecological park designed to function with the natural flood process. Through the implementation of various resiliency and ecological restoration interventions developed within the master plan, the park could become a valuable community laboratory that focuses on providing recreational opportunities in a manner that minimizes conflict with the natural process, adapts to changing climate and weather events, and educates the public about these ecological and cultural relationships.

Community Support

The plan should include the development of resiliency-focused educational programs and opportunities within the park and employ a comprehensive community engagement process to explain how re-imagining the park's relationship with natural processes, flooding, and riparian or wetland ecologies can align with cultural and recreational needs. Future improvements to the park should focus on the public's desire to become more integrated with nature and showcase how traditional infrastructure can be made more adaptable and sustainable.

Resilience Relative to Scenarios

The master plan will identify the most adaptable resiliency strategies for varied risks throughout the park, including areas vulnerable to both high- and low-water conditions. Specific strategies will be evaluated on a case-by-case basis within the master plan process. In general, in high-water scenarios, adaptable nature-based strategies may absorb flood water, reduce flood levels, buffer and dissipate wave energy, or otherwise be designed to return to service after an event. Most strategies may also adapt to low-water scenarios if designed to function as a diverse riparian system.

Ellison Park
Resiliency Master Plan

Past Flooding Events

Wet fields (April 2009, Monroe County GIS, Pictometry)

Flooding near existing dog park (2015, Monroe County GIS, Pictometry)

Project #17

Ellison Park Resiliency Master Plan

Implementation

An Ellison Park Resiliency Master Plan would include relevant data collection and analysis, identification and concept-level engineering of site-specific resiliency and adaptation strategies, documentation of probable costs and potential phasing for each plan initiative. Development of a resiliency master plan for the park should be completed in the short (1-2 years) to medium (3-5 years) timeframe. Individual resiliency and adaptation strategies identified within the master plan should be implemented in the medium (3-5 years) to long (5+ years) timeframe. It is recommended that the Master Plan be completed by 2025 so that resiliency measures can start to take effect in the 2030s.

Timeframe

1 to 2 years | 3 to 5 years | 5+ years

Estimated Cost[1]

$200,000 to $275,000

[1] This includes professional service and technical / lab fees for a consultant team with appropriate multidisciplinary experience with resiliency, environmental investigations and permitting, stormwater and green infrastructure, coastal hydrology, landscape architecture, ecosystem and wetland planning and design engineering, park and recreational master planning, and historic preservation. Costs to prepare a master plan are increased due to the scale of the park and the specialty hydrological, ecological, and natural systems engineering expertise required. A detailed scope of services should be developed by Monroe County prior to finalizing the project budget. The construction costs and implementation budget for phased resiliency interventions identified within the master plan would be prepared and prioritized during the master plan process to meet available Monroe County capital projects funding.

Cost-Benefit Analysis

The project cost is an investment in the popular public recreational resource that will allow for the phasing and planning of future resilient systems based on the natural systems process. The resulting reduction in exposure and vulnerability from implementation of the plan will preserve the recreational and environmental resource and yield high returns in economic recreational and tourism activity in the region.

Potential Funding Sources

Funding for this project could come from a variety of State sources including the LWRP, EPF, and WQIP streams through the CFA as well as from the GIGP. Funds may also be available from the Great Lakes Restoration Initiative.

Conceptual Rendering

Illustrative rendering showing resiliency retrofit of existing field to function as a holistic ecosystem with new recreational opportunities.

Project #17

Ellison Park Resiliency Master Plan

Required Permits or Approvals

No permit requirements are anticipated for planning projects. Future implementation of capital projects identified within the master plan would require multi-jurisdictional permit review, including Army Corps of Engineers, New York State Department of Environmental Conservation, among others.

Potential Challenges

Project challenges include lack of funding, particularly funding required to implement future capital projects and interventions identified within the master plan project. Additional challenges include potential public and cultural conflicts regarding visual changes to the park landscape that make it more naturalistic and dynamic near the riparian and floodway areas.

While significant changes can be difficult to adapt to for some park users, the public landscape resiliency concepts likely employed by the master plan are highly desirable, modern park experiences that connect communities to the natural process and the environment.

Elevating some park infrastructure has been discussed but feasibility is challenging due to the resulting displacement of flood waters that would occur in other areas of the park or along the creek. Impacts of filling land within the floodplain can increase risk and exacerbate flood impacts elsewhere along the creek.

Conceptual Plan

Illustrative rendering showing resiliency retrofit of existing field to function as a holistic ecosystem with new recreational opportunities.

Basic Info

Location: Genesee Riverway Trail, Rochester

Site owners: City of Rochester

Jurisdiction: City of Rochester

Potential sponsors: City of Rochester

Resiliency Area

Natural + Cultural Resources

Related Goals

- Design with Nature

Complementary Projects

- 21 Turning Point Park Master Plan + Boat Launch
- 5 Porous Pavement Impervious Surface Reduction

Project #18

Genesee Riverway Trail
Green Infrastructure Program

Project Description

This project addresses the opportunity to leverage the significant active transportation assets within the City of Rochester, including the Genesee Riverway Trail (GRT) and secondary trails, greenways, or shared-use paths, to filter and absorb stormwater and reduce flows to the sewer system. The project recommends program and policy shifts to require inclusion of various appropriate green infrastructure components in new trail construction and existing trail rehabilitations throughout the City of Rochester. This policy recommendation is broadly proposed, however the Genesee Riverway Trail segment near the Port of Rochester between Petten Street and River Street has been identified as a potential pilot project area.

Demonstrated Need

Large impervious areas are common in urban environments and create additional demand on the sewer system and lead to increased flooding and sewer overflows. The continued rise in frequency and intensity of precipitation events also dramatically increases flood risks. Green infrastructure design incorporates natural processes using soils and vegetation to manage stormwater and create healthier urban environments. These practices mimic nature by absorbing, storing, and filtering stormwater.

Marina parking near the GRT is a green infrastructure opportunity

Genesee Riverway Trail
Green Infrastructure Program

Potential Benefits

Green infrastructure's core design functions are to reduce the volume of stormwater runoff that reaches streams, rivers, and lakes, and reduce pollutant loading by increasing infiltration of stormwater using natural processes. Urban runoff from impervious surfaces during increasingly common and intense precipitation events is a major contributing factor to localized flooding and property damage.

By reducing the volume of water from impervious urban environments, there is a direct reduction in community risk exposure from flood impacts. By infiltrating and treating stormwater near the source, these practices lessen the demand on traditional piped stormwater systems, reduce urban pollutants reaching the lakes and rivers, and potentially reduce damage to infrastructure and property.

Green infrastructure also directly provides significant co-benefits and ecosystem services to communities. These include supporting native species and biodiversity, fostering the natural ecological process, enhancing community public health and the connection to the natural world, and elevating property values.

True benefits from green infrastructure come at significant scales. By enacting policies that require green infrastructure solutions to be incorporated into public improvements, the combined long-term benefits are compounded and substantial.

About the Trail

The Genesee Riverway Trail includes more than 20 miles of on- and off-road shared-use trails and side paths, extending throughout the river corridor to provide connections to numerous public lands, parks, and neighborhoods from downtown to the lake. The marked trail system is a designated National Recreation Trail and provides links to other local and state trails, including the Erie Canal Heritage Trail and the 750-mile Empire State Trail.

Project #18

Genesee Riverway Trail
Green Infrastructure Program

Community Support

The proposed Genesee Riverway Trail Green Infrastructure project was ranked 3rd in priority out of 20 projects at Public Workshop #3. The project is consistent with and directly advances the goals and objectives of the City's Rochester 2034 Comprehensive Plan and the City of Rochester Local Waterfront Revitalization Program.

Resilience Relative to Scenarios

The resiliency benefits of this project are expected to perform equally well under high-and low-water conditions. The function of green infrastructure practices along trails would be to reduce runoff and improve water quality from precipitation events.

The green infrastructure system should be designed to manage increasingly heavy precipitation events up to an established overflow point specified in the design. The system would also continue to function during droughts (infrequent precipitation events). To ensure function in high- and low-water conditions, the system should be designed with a rich diversity of vegetative material that can accommodate both wet and dry conditions.

There are potentially circumstances where substantial increases in high-water conditions (highs getting higher) will reduce the effectiveness of some green site-specific infrastructure practices due to increases in groundwater elevation near the river or lake. In these conditions infiltration rates and capacity may change or slow over time, thereby reducing the volume or water prevented from entering the traditional storm system or directly

Green Infrastructure in Roc

Several City of Rochester facilities currently utilize green infrastructure practices to filter and reduce stormwater load on the city's combined sewer system. Existing practices include porous public parking areas, rain gardens in various parks, and green roofs on City facilities. The City of Rochester and Monroe County have jointly prepared a Green Infrastructure Retrofit Manual that outlines the planning, design, operation and maintenance, and construction specifications for many appropriate green infrastructure applications. This project shifts the conversation from "how to accomplish" these ecosystem services benefits to "where to accomplish" – by leveraging complimentary public landscape resources such as the Genesee Riverway Trail.

Genesee Riverway Trail
Green Infrastructure Program

Potential Design Options

Example shared-use trail green infrastructure (Flathead Conservation District)

Trail and street-side rain garden (Washington, MIG)

to adjacent water bodies. However, this condition would be limited to locations where the Genesee Riverway Trail is in low lying areas directly near the Genesee River or Lake Ontario.

Furthermore, the potential for future system issues or failures would be clearly identified in the feasibility analysis of each site.

Project #18

Genesee Riverway Trail
Green Infrastructure Program

Implementation

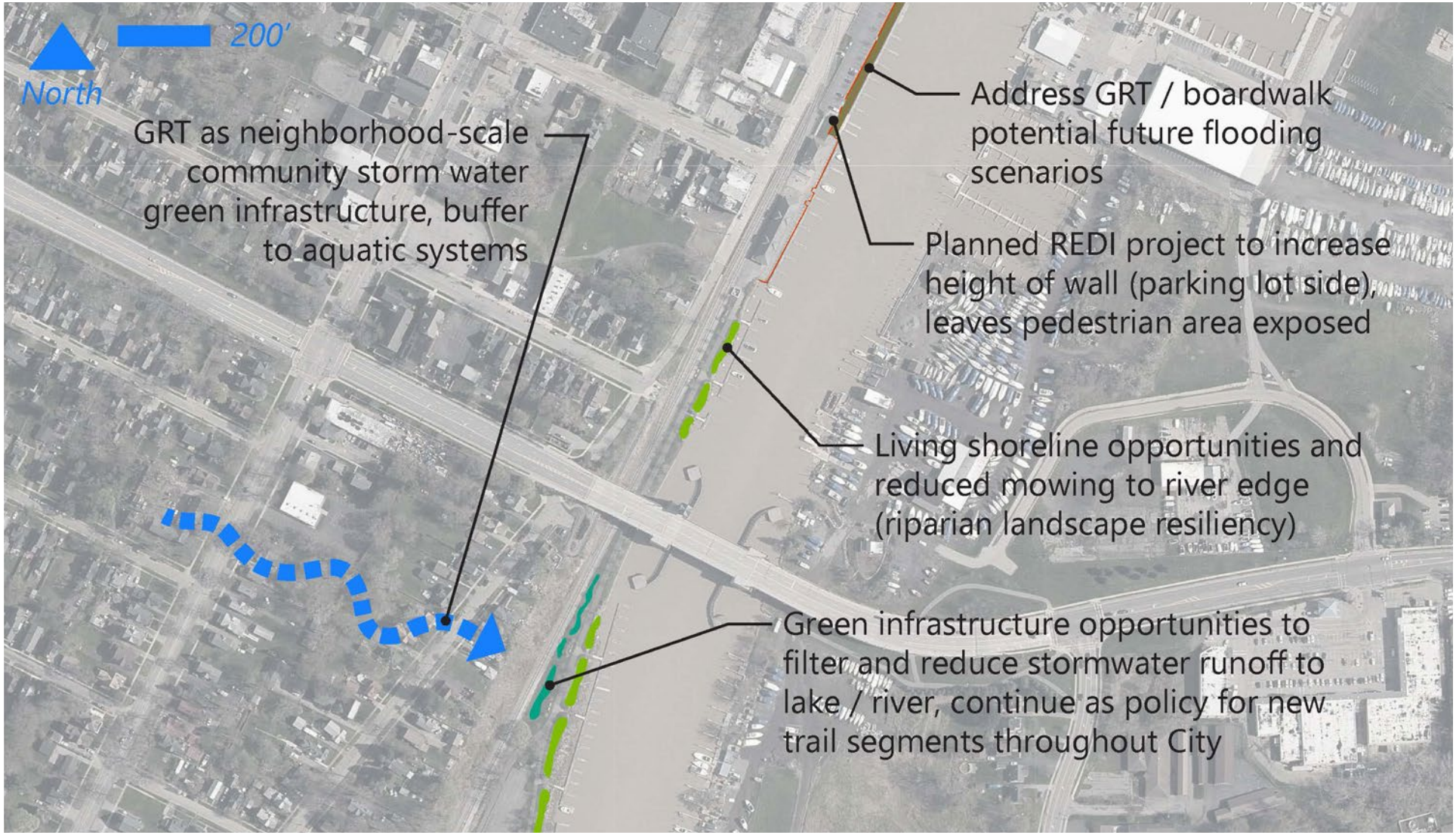
A range of appropriate green infrastructure strategies can be, and often are, incorporated into linear trail corridor lands, including rain gardens, bioswales, constructed wetlands, and permeable pavements, along with more traditional green infrastructure and ecosystem services such as increases in urban forest canopy. The purpose of this project is to expand the role of the Genesee Riverway Trail beyond recreation and non-motorized transportation and enhance the range of ecosystem services that the trail network provides the community. To achieve this the City of Rochester should encourage, or establish as policy, the inclusion of these more sustainable stormwater management strategies in both new trail projects and existing trail modifications or rehabilitations.

Incorporating green infrastructure into Genesee Riverway Trail projects would entail identifying appropriate sites along the trail network that can support various green infrastructure initiatives, performing basic inventory and analysis to determine feasibility (determining catchment areas and stormwater filtration and reduction benefits, testing infiltration, characterizing soils, etc.), and ensuring that design engineering for the green infrastructure practice is included in the scope of trail work.

Not all trail corridor areas and types are appropriate for inclusion of green infrastructure practices due to soils, limited drainage or catchment areas, or other constraining factors. The most basic and significant green infrastructure installations would be linear bioswales, rain gardens, or created wetlands along off-road shared-use trails where the width and other characteristics of the land allow intervention. However, many green infrastructure practices can be applied to on-road paths, side paths, protected bike lanes and sidewalks using porous paving, infiltration planters, or underground stormwater treatments.

A recommended timeframe to implement programmatic or policy changes that promote or require green infrastructure practices to be included in Genesee Riverway Trail projects is 1-2 years (short timeframe). It is anticipated that the program policy could be applied to trail projects in the capital improvement pipeline within a medium timeframe (3-5 years).

Conceptual Plan



Project #18

Genesee Riverway Trail Green Infrastructure Program

Timeframe

1 to 2 years | **3 to 5 years** | 5+ years

Estimated Cost

The costs of implementing program and policy changes to require inclusion of various appropriate green infrastructure components in trail rehabilitation or new construction projects would be minimal. Future implementation of green infrastructure projects along the Genesee Riverway Trail would vary per project and may increase trail project costs in some scenarios. However, in many cases the use of these practices can reduce costs. A wide variety of factors will contribute to individual cost analysis, including whether traditional stormwater piping would have otherwise been part of the project, soil and ground water characteristics, among others.

Cost-Benefit Analysis

The costs of green infrastructure are dependent on local project conditions. However, as these practices are built around natural hydrologic functions, water capture, and use of native vegetative materials, the combined benefits are extensive and wide reaching in the community.

Green infrastructure can reduce energy costs by reducing the need for fabricated raw materials traditionally associated with "grey" systems and reduce urban heat island effects by providing increased urban forest canopy. The projects can reduce flood damage and associated repair and cleanup costs. These nature-based systems also provide public health and economic benefits, including preventing disease and protecting local economies by improving water and air quality, reducing bacteria and pollutant loads, minimizing economic losses from closed beaches, and generally providing the documented physiological benefits of nearby nature.

EPA studies indicate that green infrastructure is 25% less costly to maintain than traditional storm water systems. However, while there is less total maintenance required, process and maintenance needs do change. Green

EPA Case Study

An Environmental Protection Agency analysis of 479 green infrastructure project case studies shows that incorporating green infrastructure into development projects reduced the overall project costs in more than 44% of cases. Another 31% of the case study projects did not see any influence on costs. Only 25% of the projects resulted in increased costs.

Genesee Riverway Trail
Green Infrastructure Program

infrastructure requires greater need for cyclic monitoring and attention to the installation and staff training in living ecologies (horticulture).

Potential Funding Sources

Funding for this project could come from a variety of State sources including the LWRP, EPF, RTP, and WQIP streams through the CFA as well as from the GIGP. Funds may also be available from the Great Lakes Restoration Initiative.

Required Permits or Approvals

No permit requirements are anticipated for enacting programs and policy requirements regarding future planning and design of the Genesee Riverway Trail. However, advanced design and implementation of capital projects resulting from the program will require municipal and agency reviews from the City of Rochester and/or Monroe County. In some cases, multi-jurisdictional permit review may be required where site ownership, location, or other conditions are present.

Potential Challenges

The challenges to implementing program and policy changes include assembling initial political and technical momentum and staff resources to thoughtfully advocate and define the policy specifics, lack of political desire, or lack of budgets. It will require bold decisions from policy makers to ensure that such practices are standard in public trail projects. While challenges may exist to include these practices in capital projects due to increased initial construction costs, with a commitment to reducing the impacts of stormwater on the community it is feasible to fully implement the policy program in the next 3 to 5 years.

Additional challenges may exist in implementing the green infrastructure projects along the GRT, including lack of construction funding, unconventional maintenance needs / training, and political obstacles to potential green infrastructure mandates.

Basic Info

Location: Hamlin Beach State Park

Site owners: NYS-OPRHP

Jurisdiction: NYS-OPRHP, Town of Hamlin

Potential sponsors: NYS-OPRHP

Resiliency Area

Natural + Cultural Resources

Related Goals

- Design with Nature

Complementary Projects

- 13 Coastal Bluff and Beach Protection
- 5 Porous Pavement Impervious Surface Reduction
- 2 Shoreline Data Needs Planning Study

Project #19

Hamlin Beach State Park
Resiliency Master Plan

Project Description

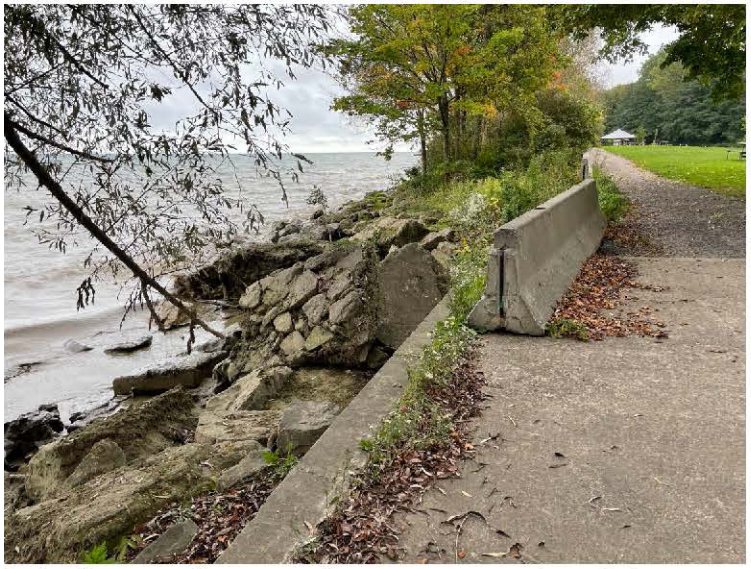
This project addresses the need to strategically master plan for future funding, design, and implementation of various resiliency and adaptation strategies within Hamlin Beach State Park over time. The resulting Hamlin Beach State Park Resiliency Master Plan would ultimately identify and phase a variety of short, medium, and long-term capital project initiatives focused on improving resiliency to changes in water levels and flooding and which support swift and effective recovery from these events.

Demonstrated Need

Hamlin Beach State Park is a popular beachfront recreational asset with more than 3.4 miles of shoreline on Lake Ontario. It provides many recreational opportunities to residents and tourists, including swimming beaches, campgrounds, bathhouses, concessions, picnic shelters, fishing opportunities, trails, a hand-carry boat launch, and more. There are also significant historic and cultural resources, including unique New Deal / CCC-era masonry structures and site features. The park and associated recreational opportunities are an important source of economic activity and employment in the Town of Hamlin and the region.

Risk mapping indicates that park infrastructure, including areas of campground, beach, circulation network, historic structures, and other facilities may be impacted by rising water levels or flooding. A concrete lakefront walkway with a narrow armored rip-rap embankment shoreline is located along a lowland lawn area that is noted as high

Existing Conditions



Lake front walkway and pavement undermining from wave action

Historic resources

Utilities and structures in risk area

Armored shoreline areas

Armored creek / drainage outfalls to lake

Project #19

Hamlin Beach State Park Resiliency Master Plan

risk to flood events. Pre-cast concrete barriers were placed along the walkway several years ago as a temporary measure to protect from erosion and minimize inland impacts of high-water events. The barriers remain today and substantially reduce public accessibility and ease of access to the shoreline. The concrete walkway has also been significantly undermined by wave action resulting in settlement of the lakeside concrete and extensive longitudinal pavement cracking.

Based on an initial observation of park conditions, multiple adaptation strategies would likely be needed to reduce exposure and vulnerability. These include infrastructure relocation, preservation or enhancement of open space, wetland creation, green infrastructure improvements, development of living shorelines, and elevation of existing infrastructure.

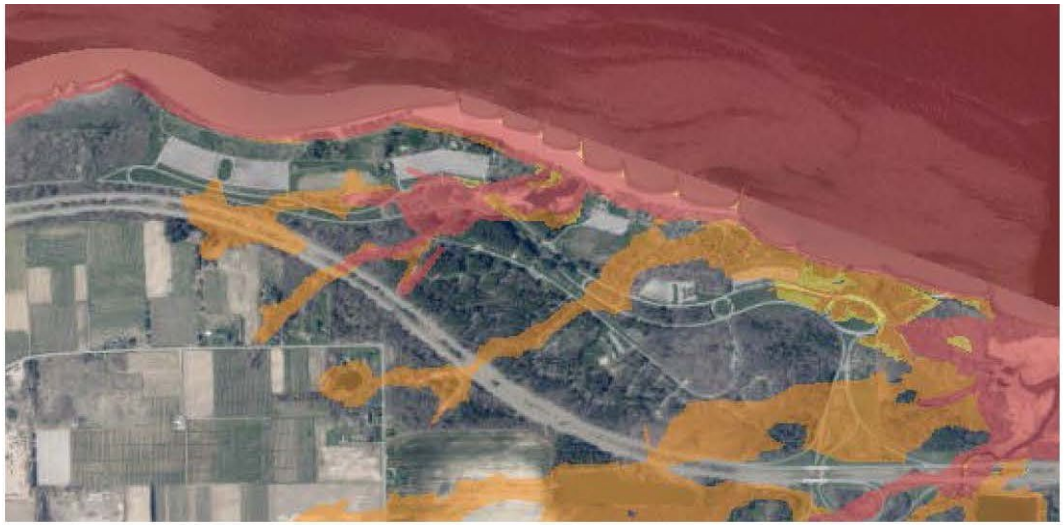
Potential Benefits

An updated master plan and resulting phased resiliency initiatives would reduce exposure and vulnerability. Using up-to-date site inventory and analysis, the master plan would identify appropriate practices and strategies to moderate the effects of flood hazards or other conditions and increase the ability for the park to recover from hazard conditions.

Benefits of the planning effort may include sustaining and enhancing public access to recreational assets and the lakefront, reducing impervious surface area within the sensitive riparian and coastal zones, and preserving the ecological health of nearby marshes and wetlands. By promoting the most adaptable resiliency strategies and prioritizing designing with natural processes, the project would also include several co-benefits. These include increased biodiversity, ecosystem services, increased public health, enhanced public shoreline accessibility, and potentially new recreational opportunities.

Economic benefits resulting from making Hamlin Beach State Park more resilient include economic activity from regional tourism and recreation, private and public sector employment, and increased nearby property values. The park includes 260 campsites and attracted more than 380,000 visitors in 2020 according to New York State.

Existing Conditions



NYS-DOS Risk Map showing high and extreme risk areas within the park

Relationship with lake (Monroe County GIS, Pictometry)

Park includes 24+ acres or asphalt parking lots

Prior flood / erosion control efforts (barrier wall), pavement undermining

Project #19

Hamlin Beach State Park
Resiliency Master Plan

Community Support

The project has high support based on feedback received during the CLEAR planning process. It ranked fifth of all projects in the prioritization exercise at Public Workshop #3.

Resilience Relative to Scenarios

The master plan will identify the most adaptable resiliency strategies for varied risks throughout the park, including areas vulnerable to both high and low-water conditions. Specific strategies will need to be evaluated on a case-by-case basis within the master plan process. In general, in high-water scenarios, adaptable nature-based strategies may absorb flood water, reduce flood levels, buffer and dissipate wave energy, or otherwise be designed to return to service after an event. Most strategies may also adapt to low-water scenarios if designed properly.

Implementation

A Hamlin Beach State Park Resiliency Master Plan would include relevant data collection and analysis, identification and concept-level engineering of site-specific resiliency and adaptation strategies, documentation of probable costs and potential phasing for each plan initiative. The plan should also include development of resiliency-focused educational programs and opportunities within the park as well as cultural resource investigations specific to assessing risk and improving the resilience of historic structures.

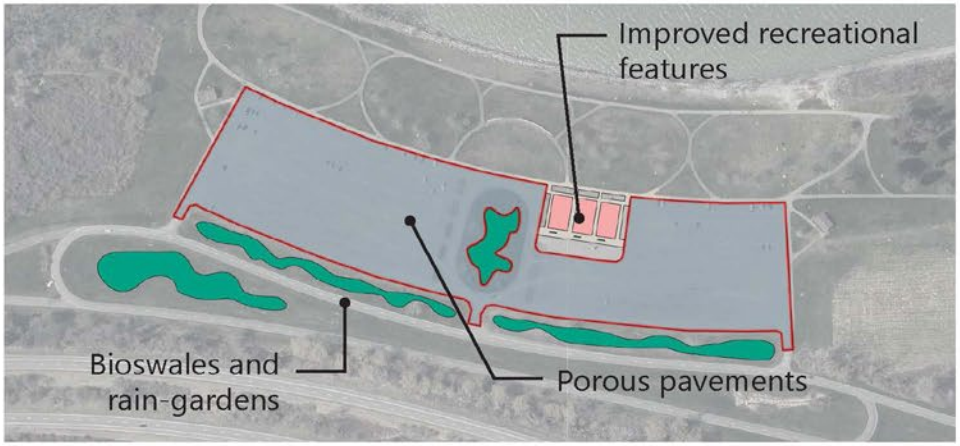
Development of a resiliency master plan for the park should be completed in the short (1-2 years) to medium (3-5 years) timeframe. Individual resiliency and adaptation strategies identified within the master plan should be implemented in the medium (3-5 years) to long (5+ years) timeframe.

About the Park

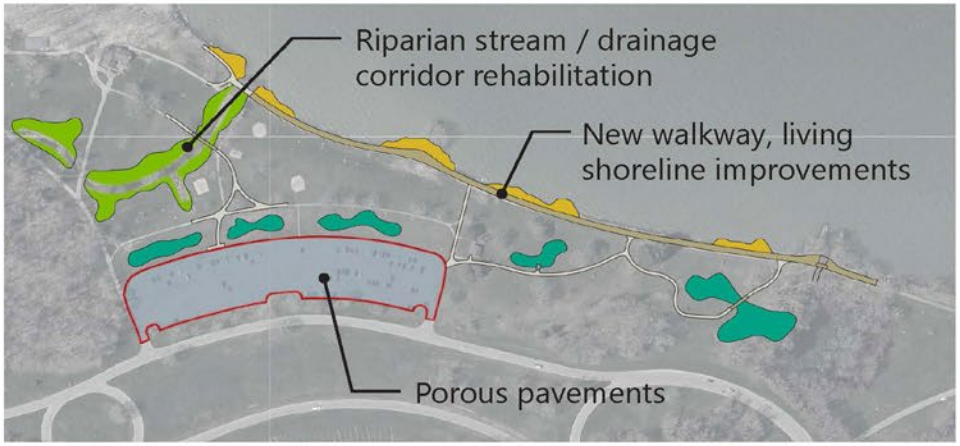
Hamlin Beach State Park has a diverse and complex hydrology, including several creeks and riparian corridors, various ponded, shrubby, and forested wetlands, and a range of constructed drainage infrastructure from various decades. It also includes five parking areas with more than 22 acres of asphalt impervious surface (in varying condition).

A 1970s era Army Corps of Engineers drainage and erosion control project made significant alterations to portions of the shoreline and swimming beaches, including the addition of large stone groins to combat beach erosion, preserve shoreline and upland property, and enhance beach areas for public use.

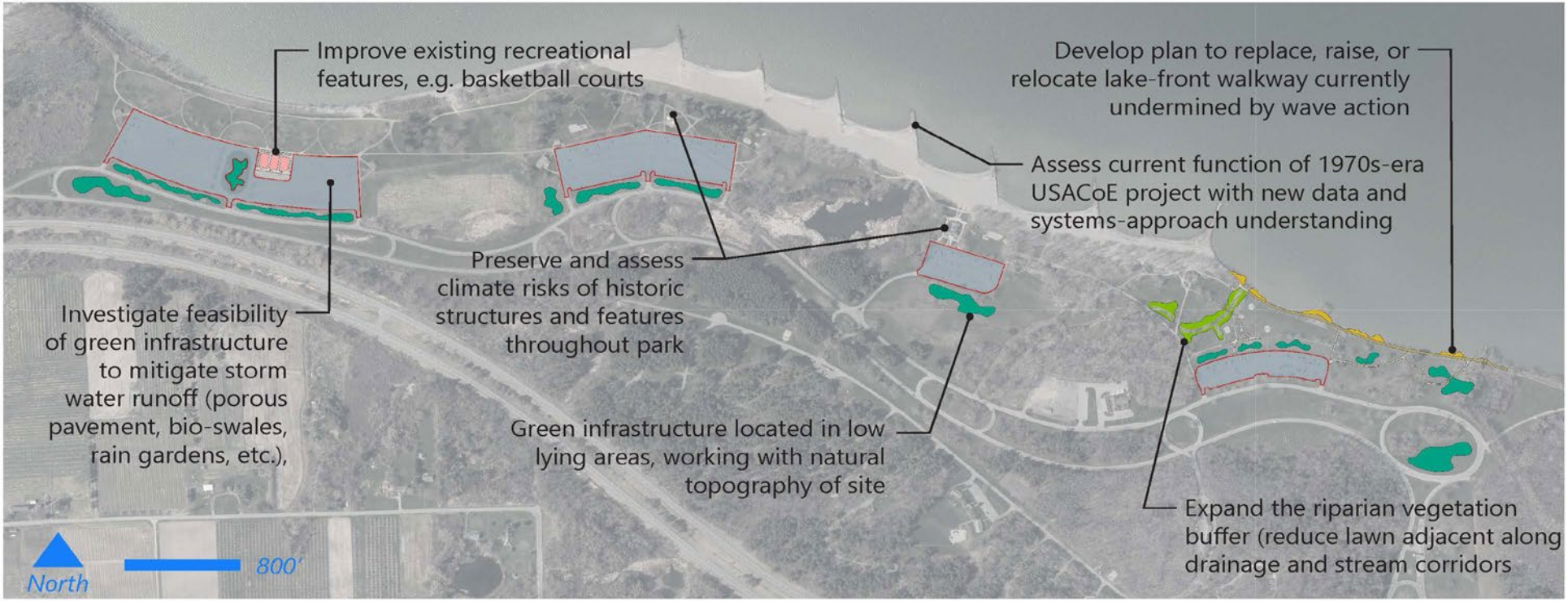
Conceptual Plans



Enlargement showing green infrastructure and recreational opportunities



Enlargement showing riparian stream and shoreline platings, new walkways



Project #19

Hamlin Beach State Park Resiliency Master Plan

Estimated Cost[1]

$200,000 to $275,000

[1] This includes professional service and technical / lab fees for a consultant team with appropriate multidisciplinary experience with resiliency, environmental investigations and permitting, stormwater and green infrastructure, coastal hydrology, landscape architecture, ecosystem and wetland planning and design engineering, park and recreational master planning, and historic preservation. Costs to prepare a master plan are increased due to the scale of the park and the specialty hydrological, ecological, and coastal engineering expertise required. A detailed scope of services should be developed by the NYS-OPRHP prior to finalizing the project budget. The construction costs and implementation budget for phased resiliency interventions identified within the master plan would be prepared and prioritized during the master plan process to meet available NYS-OPRHP capital projects funding.

Timeframe

1 to 2 years | 3 to 5 years | 5+ years

Cost-Benefit Analysis

The project cost is an investment in the popular public recreational resource that will allow for the phasing and planning of future resilient systems based on natural systems processes. The resulting reduction in exposure and vulnerability from implementation of the plan will preserve this recreational and environmental resource and yield high returns in economic, recreational, and tourism activity in the region.

Potential Funding Sources

Funding for this project could come from a variety of State sources including the NYS-OPRHP, EPF, and WQIP streams through the CFA as well as from the GIGP. Funds may also be available from the Great Lakes Restoration Initiative.

Required Permits or Approvals

No permit requirements are anticipated for planning projects. Future implementation of capital projects identified within the master plan would require multi-jurisdictional permit review, including from the Army Corps of Engineers, New York State Department of Environmental Conservation, among others.

Hamlin Beach State Park
Resiliency Master Plan

Devil's Nose

The furthest northern point of Hamlin Beach State Park is a high sand bluff known as Devil's Nose. This steep and eroded bluff includes a significant underwater sandy shoal extending into the lake and serves as a major source of coarse sediment (sand) that builds and maintains beaches and coastal habitats along the shoreline to the east towards Braddock Bay.

Potential Challenges

Project challenges include lack of funding, particularly funding likely required to implement future capital projects and interventions identified within the master plan. Additional challenges include potential environmental conflicts regarding facilitating the sediment transport benefits of erosion and the desire to prevent erosion to preserve land.

NYS-OPRHP has also expressed some concerns regarding further encroachment of structures or facilities into the lake.

Basic Info

Location: Salmon Creek Park, Hilton

Site owners: Village of Hilton

Jurisdiction: Village of Hilton

Potential sponsors:
Village of Hilton, Town of Parma

Resiliency Area

Natural + Cultural Resources

Related Goals

Design with Nature

Complementary Projects

5 Porous Pavement Impervious Surface Reduction

Project #20

Salmon Creek Park
Resiliency Pilot Project

Project Description

This project addresses the need to rehabilitate Salmon Creek Park using resiliency and adaptation strategies that will reduce vulnerability to flood events along Salmon Creek. The project intent is to both rehabilitate the park to better serve residents and showcase how nature-based strategies can make other more vulnerable properties along Salmon Creek more resilient to high-water events. The project proposes to redesign components of the park to better withstand flood events, enhance ecological systems and processes along the riparian fringe, and serve as a model demonstrating how community recreation infrastructure and riparian floodways can co-exist.

Demonstrated Need

The flood risks posed by Salmon Creek within the Village of Hilton are high, with several businesses, single and multi-family residences, and other facilities situated within or near the regulatory floodway and SFHA. The village has historically experienced localized flooding along the creek, including an often-cited 2004 event that caused more than $400,000 in damages.

Potential Benefits

The rehabilitation of Salmon Creek Park to employ nature-based resiliency and adaptation strategies would reduce exposure and vulnerability, facilitate efficient recovery from hazard events, and enhance public recreational opportunities along the creek. The project would also serve as a pilot effort by implementing and showcasing

Existing Conditions

High water event along creek (2019)

Hand-carry boat launch

View from former railroad bridge to park and creek

Project #20

Salmon Creek Park
Resiliency Pilot Project

successful strategies that may be employed elsewhere within the village to reduce exposure and vulnerability at other public or private properties. It can help expand the role of parks in riparian areas without removing or altering highly desired recreational assets such as ball fields or playgrounds.

The project can also expand amenities at the park, of which there are currently very few according to the 2020 Comprehensive Plan Recreational Inventory. The Comprehensive Plan specifically identified the Salmon Creek corridor as an opportunity for nature-based recreational opportunities to be further developed, including trails and greenways.

About the Park

Salmon Creek Park is a relatively small and secluded public park on the northern bank of Salmon Creek within the Village of Hilton. The total land area of the park is 4.3 acres, however the functional and accessible portion on the north side of Salmon Creek is approximately 1.5 acres. The park consists of a modest informal parking lot, open lawn, a sidewalk along the creek edge, a park grill, and a small concrete foundation for a since-removed structure which now has been repurposed as a small basketball court. Salmon Creek runs through the park land and a non-accessible trail connection leads up to an inactive railroad bridge on the former Hojack rail line. The site also includes a host of above ground and underground utilities and a stormwater or other wet-pond area. Virtually no riparian buffer exists in the park, with lawn maintained and mown up to the top of bank and creek edge.

Salmon Creek Park
Resiliency Pilot Project

Community Support

The project would compliment the goals of the Village of Hilton Comprehensive Plan, particularly the long-term effort to implement more nature-based community services along the floodway, including trails and greenways connecting various parks, schools, and businesses.

Resilience Relative to Scenarios

The purpose of the project is to redefine how the park functions in both high and low-water scenarios. Most of the adaptation strategies that would be employed within the park, including berms, living shorelines, green infrastructure, and riparian buffer creation can adapt to low-water conditions. Strategies that are not as adaptable to low-water scenarios, such as infrastructure elevation, raising walkways or other amenities, would be used infrequently or strategically implemented in conjunction with other strategies to allow extended use of the park facilities in all conditions. The result of the rehabilitation would be to develop a park that is designed to flood while still serving community recreational needs during low-water events.

Implementation

A Salmon Creek Park Resiliency Pilot Project would consist of the design and construction of new park infrastructure and amenities, including resiliency systems such as green infrastructure, berms, living shorelines, bioswales and rain gardens, and porous pavements, as well as upgraded cultural and recreational opportunities. The project should include a robust community engagement process that identifies the community's desired recreational needs and opportunities and also educates about broader community risks posed by high-water events along Salmon Creek and elsewhere within the village of Hilton.

Implementing a Salmon Creek Park Resiliency Pilot Project is expected to require 3-5 years. Preliminary and final design engineering and permitting could feasibly be accomplished in 1-2 years, provided funding is available. With adequate funding, the design and completion of the project could occur by 2025. Assuming appropriate design parameters are applied, it can be expected that the project will continue to perform in high water events through the 2050s and beyond.

Timeframe

1 to 2 years | 3 to 5 years | 5+ years

Project #20

Salmon Creek Park Resiliency Pilot Project

Estimated Cost[1]

$600,000 to $900,000

[1] This estimated project cost includes $80,000 to $120,000 in professional service and technical fees for a consultant team with appropriate multidisciplinary experience with resiliency, environmental investigations and permitting, stormwater and green infrastructure, hydrology, landscape architecture, ecosystem and wetland planning and design engineering, park and recreational design, and construction administration and inspection. The remaining $480,000 to $820,000 includes contingency and construction costs. A detailed scope of services should be developed by the Village of Hilton prior to finalizing the project budget. Construction costs and an implementation budget for phased resiliency interventions identified within the master plan would be prepared and prioritized during the planning process.

Cost-Benefit Analysis

The project cost is an investment in this public recreational resource that will facilitate new recreational opportunities, significantly reduce the vulnerability of the park, and provide the community with greater understanding of resiliency and adaptation strategies that may be employed at other sites.

Potential Funding Sources

Funding for this project could come from a variety of State sources including EPF, and WQIP streams through the CFA as well as from the GIGP. Funds may also be available from the Great Lakes Restoration Initiative.

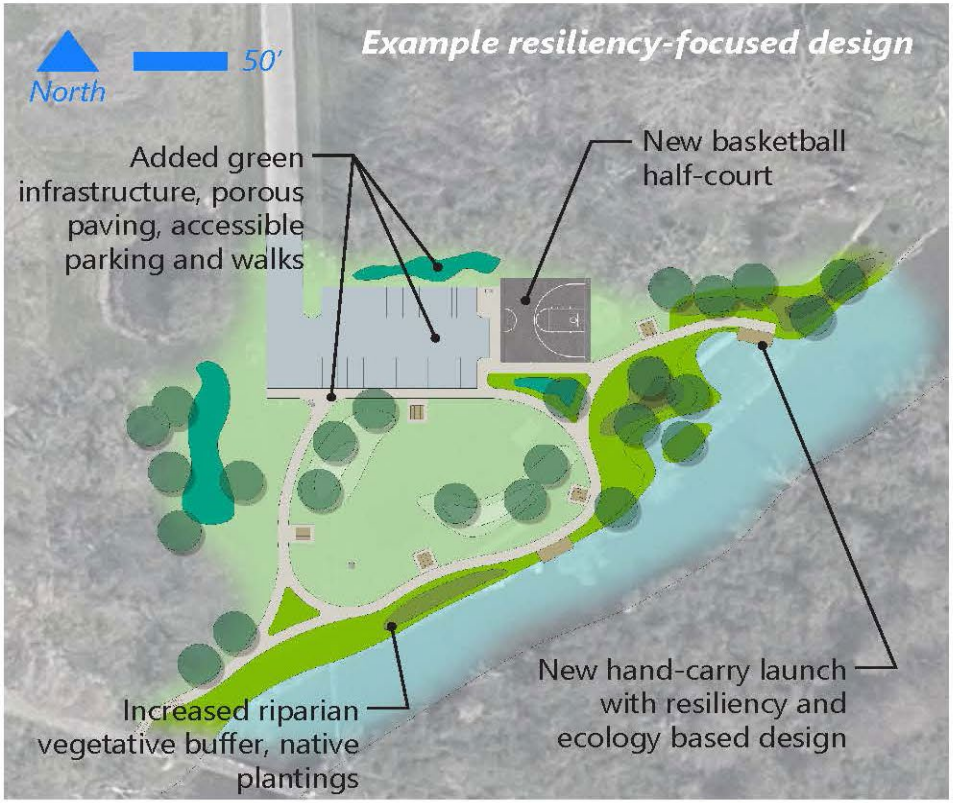
Required Permits or Approvals

The project will require multi-jurisdictional review and permitting, including but not limited to:

- US Army Corps of Engineers, Federal Waters / Wetlands Permit
- US Fish and Wildlife Services, Threatened and Endangered Species Act Compliance Consultation
- NYS-Department of Environmental Conservation, Coastal Erosion Hazard Area Permit, Freshwater Wetlands Permit, Article 15 Protection of Waters Permit, Water Quality Certificate, State Environmental Quality Review Act (SEQRA), and SPDES General Permit for Stormwater Discharges from Construction Activity
- NYS-Department of State, Federal and State Coastal Consistency Review
- Village or Hilton, Site Plan review, Consistency with Zoning and Local Waterfront Revitalization Plan, Floodplain Development Permit

Salmon Creek Park
Resiliency Pilot Project

Example Plan



Project #20

Salmon Creek Park
Resiliency Pilot Project

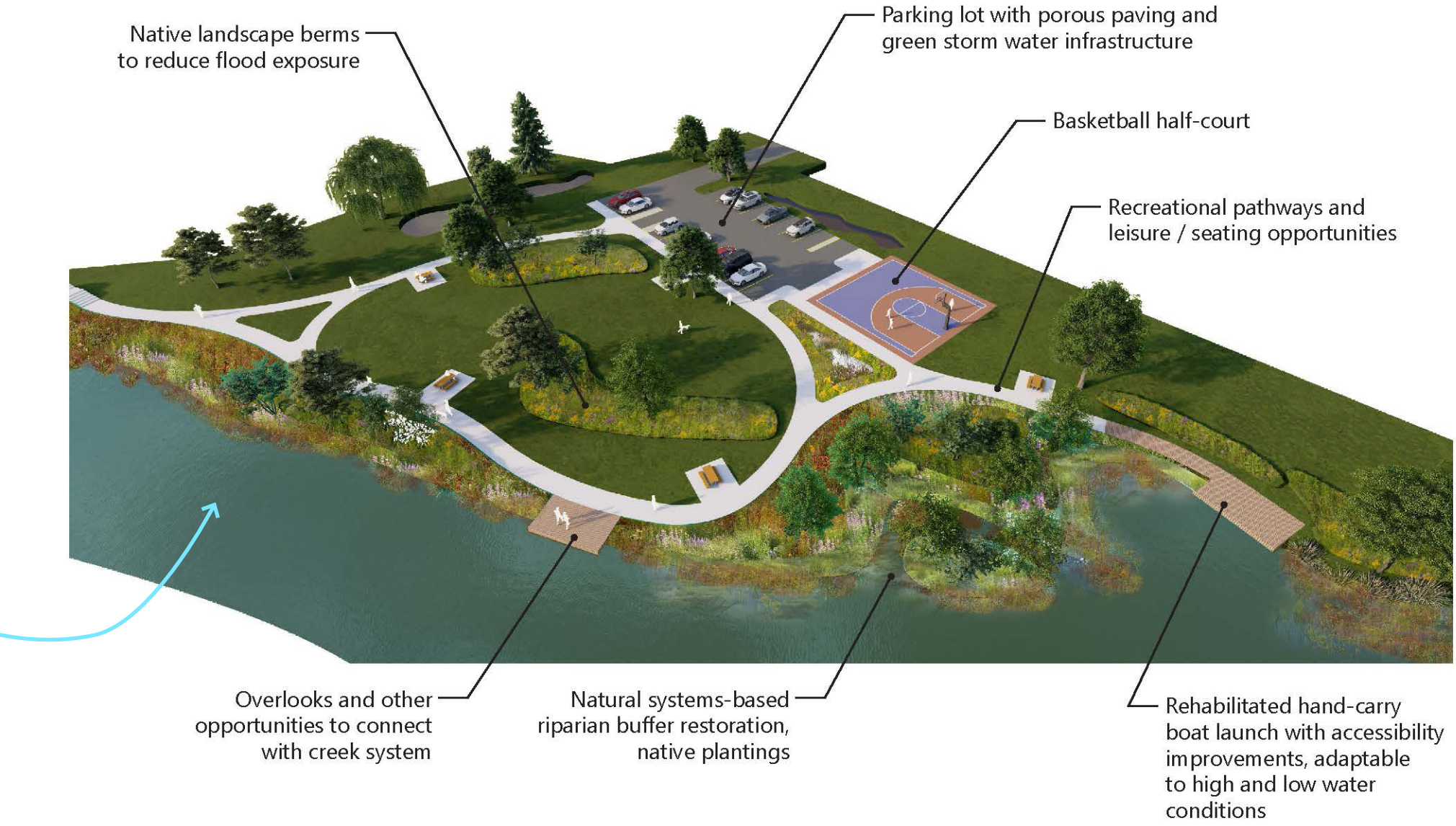
Additional review and permits may be required beyond those noted. The permits would generally be acquired through a Joint Application Form (JAF).

Potential Challenges

Beyond funding, the most significant obstacle to successful implementation of the project is the added constraints of underground and overhead utilities that may prevent the construction of some types of adaptation strategies in areas or limit the ability to make significant changes to portions of the park. Sanitary sewer manholes, gravity mains, and interceptor pipes exist within the park and along the creek.

Existing Conditions

Conceptual Plan



Basic Info

Location: Turning Point Park, Rochester

Site owners: City of Rochester

Jurisdiction: City of Rochester

Potential sponsors: City of Rochester

Resiliency Area

Natural + Cultural Resources

Related Goals

- Design with Nature

Complementary Projects

- 18 Genesee Riverway Trail Green Infrastructure Program
- 5 Porous Pavement Impervious Surface Reduction

Project #21

Turning Point Park
Master Plan + Boat Launch

Project Description

This project addresses the City of Rochester's desire to prepare a long-range master plan to identify, prioritize, and phase the implementation of various resiliency, recreational, and park infrastructure improvements at Turning Point Park. The development of a Turning Point Park Master Plan, along with a capital project focused on the rehabilitation of hand-carry boat launch facilities, would ultimately enhance public access to the river, preserve and promote environmental and recreational assets, and increase the park's resilience to potential changes in water levels.

Demonstrated Need

While no prior closures due to high-water events were documented at Turning Point Park, the site is deeply connected to the hydrology and vegetative conditions of the Genesee River and adjacent upland stormwater catchment areas. The site was also identified as a high risk asset in the Risk Assessment. Planning for the management, long-term enhancement, and increased resiliency of the park's features will allow continued use of this asset by the community.

Potential Benefits

Development of a comprehensive master plan for Turning Point Park would reduce exposure and vulnerability, facilitate efficient recovery from hazard events, and enhance public access to the Genesee River. The planning study would identify service gaps, develop a future vision for the park that is consistent and compatible with documented natural

Existing Conditions

Existing green infrastructure in parking lot

Hand-carry launch and boardwalk landing area

Landing area

Storm water outfalls within park

Elevated boardwalk over river

Project #21

Turning Point Park
Master Plan + Boat Launch

processes, and allow for prioritization and budgeting of future recreational and facilities improvements. Near-term implementation of the hand-carry launch rehabilitation component would serve an immediate need, expanding recreational river access to a wider array of users and user types and in a segment of the river that has limited access opportunities due to terrain and geography.

Community Support

This project is consistent with the goals of the City of Rochester's 2034 Comprehensive Plan and Local Waterfront Revitalization Program.

About the Park

Turning Point Park is a highly valued and unique public park situated on an upland ravine landscape overlooking a former wide water turning basin within the lower Genesee River. It includes 275 acres of woodlands overlooking the river, steep ravine embankments, a segment of the Genesee Riverway Trail, and other minor walking paths and hiking trails. A signature experience at Turning Point Park is a walk on the nearly 3,600-foot-long boardwalk over the river turning basin, a uniquely recognizable segment of the city-wide Genesee Riverway Trail network. The boardwalk does not appear to have been impacted by the most recent high-water events in 2017 and 2019, however a more comprehensive analysis on exposure and vulnerability to hazard events should be conducted as part of the planning process.

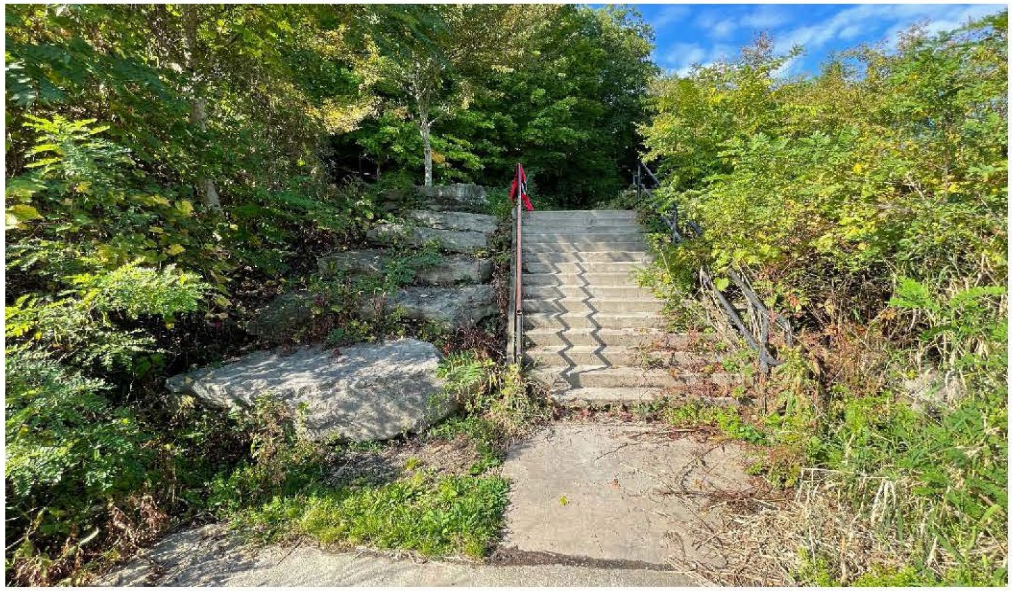
The park includes a small porous pavement parking lot with stormwater green infrastructure at the top of the ravine, a 1,200-foot-long path to a small gathering space, trail junction, and hand-carry launch area at the river's edge, and a multitude of smaller hiking and walking paths through woodlands, with views to the turning basin, interesting historic infrastructure remnants, and a small waterfall. Portions of the existing porous pavement parking lot are failing and should be rehabilitated.

Existing Conditions

Existing hand-carry boat launch

Upland trails and recreational assets

Boat launch area (2008)



Steps to existing boat launch

Project #21

Turning Point Park
Master Plan + Boat Launch

Resilience Relative to Scenarios

The master plan component of the project will identify the most adaptable resiliency strategies for the riverfront, including anticipating performance in both high and low water scenarios. While much of the park's upland features are not impacted by water-level changes, they are part of a broader stormwater catchment area that overflows to the river through historical conveyance infrastructure. The plan is expected to identify methods to increase resiliency of park assets to potential high-precipitation flood events. The study will also confirm if the Genesee Riverway Trail boardwalk through the park is at risk to flooding during future extreme high-water scenarios.

Implementation of the project's boat launch rehabilitation component is expected to increase resiliency of the recreational asset and allow for more consistent, accessible, and convenient access to the river during high water events. It is expected that the launch can adapt to both high and low water scenarios by engineering the launch features to adapt to changing water levels (floating docks or other methods), removing invasive species, and stabilizing native vegetative growth designed in concert with natural processes.

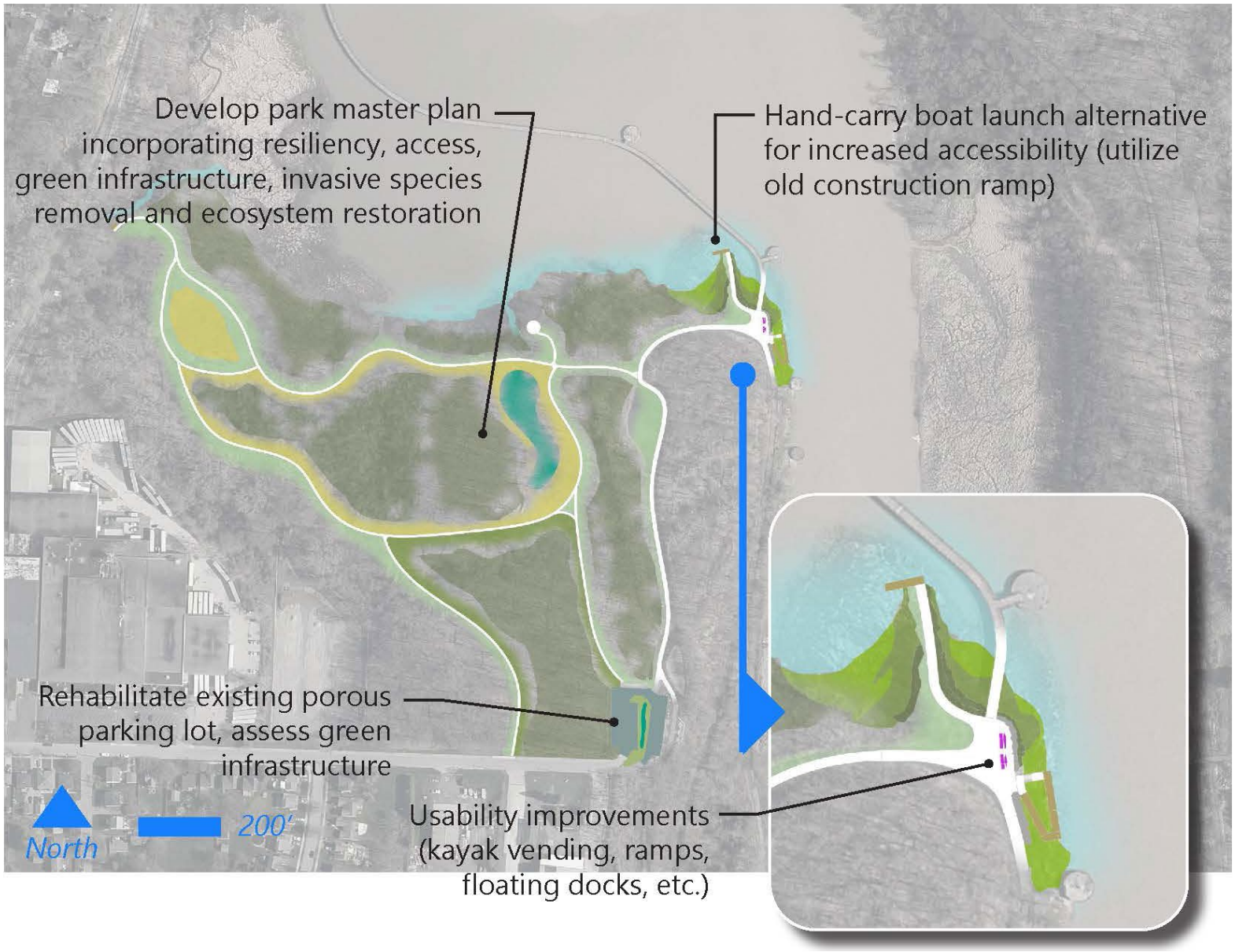
Implementation

A Turning Point Park Master Plan and Hand-Carry Boat Launch Rehabilitation project would consist of two distinct efforts combined into a single compatible project. These include the comprehensive long-range planning of park facilities with an emphasis on resiliency and the near-term implementation of a project to relocate and/or rehabilitate the hand-carry boat launch to make it more accessible, modernize it, and increase capacity.

Using relevant data collection and analysis, the master plan should identify park assets, needs and opportunities, explore expansion of potential recreational opportunities and programming, and further investigate exposure and vulnerability of the park's assets in the face of potential hazards, including changes in water levels, flooding, and the ability to effectively recover from such events.

The planning effort should focus on conceptual design of enhancements in several broad areas, including user access, resiliency, green infrastructure, invasive species removal, and ecosystem health and restoration. Upon approval of the preliminary master plan, it is recommended that the project prioritize launch rehabilitation and proceed into

Conceptual Plan



Kayak vending example

Adaptive launch example

Project #21

Turning Point Park
Master Plan + Boat Launch

detailed engineering design, permitting, and implementation. Other master plan initiatives and park enhancements may be phased over time or included in an initial phase capital project implementation.

Developing a master plan for Turning Point Park along with the preliminary design for rehabilitation of the hand-carry boat launch should be completed within the short (1-2 years) timeframe. Due to the permitting complexity and ecologically sensitive nature of implementation of the launch component, it is anticipated that construction of the launch could feasible be completed in the medium timeframe (3-5 years). Additional plan-identified improvements may be phased in over time in the medium (3-5 years) and long (5+ years) timeframes based on funding availability.

Estimated Cost[1]

$800,000 to $1,000,000

[1] This estimated project cost includes $100,000 to $150,000 in professional service and technical / lab fees for a consultant team with appropriate multidisciplinary experience with resiliency, environmental investigations and permitting, stormwater and green infrastructure, coastal hydrology, landscape architecture, ecosystem and wetland planning and design engineering, park and recreational master planning, and historic preservation. The remaining $700,000 to $900,000 includes the final design engineering, contingency, construction phase observation, and construction costs. A detailed scope of services should be developed by the City of Rochester prior to finalizing the project budget.

Timeframe

1 to 2 years | 3 to 5 years | 5+ years

Cost-Benefit Analysis

The project cost is an investment in this popular public recreational resource that will facilitate enhanced access to the Genesee River and the planning and implementation of resilient systems based on natural processes.

Potential Funding Sources

Funding for this project could come from a variety of State sources including the LWRP, EPF, and WQIP streams through the CFA as well as from the GIGP. Funds may also be available from the Great Lakes Restoration Initiative.

Required Permits or Approvals

No permit requirements are anticipated for planning projects. However, the advanced design and implementation of capital projects identified within the master plan, including the rehabilitated

Turning Point Park
Master Plan + Boat Launch

hand-carry boat launch, would require multi-jurisdictional permit review, including but not limited to:

- US Army Corps of Engineers, Federal Waters / Wetlands Permit
- US Fish and Wildlife Services, Threatened and Endangered Species Act Compliance Consultation
- NYS-Department of Environmental Conservation, Coastal Erosion Hazard Area Permit, Freshwater Wetlands Permit, Article 15 Protection of Waters Permit, Water Quality Certificate, State Environmental Quality Review Act (SEQRA), and SPDES General Permit for Stormwater Discharges from Construction Activity
- NYS-Department of State, Federal and State Coastal Consistency Review
- City of Rochester, Site Plan review, Consistency with Zoning and Local Waterfront Revitalization Plan, Floodplain Development Permit

Additional review and permits may be required beyond those noted. The permits would generally be acquired through a Joint Application Form (JAF).

Potential Challenges

Aside from the lack of identified funding for the project, few challenges are expected to impede the development of the master plan or launch rehabilitation. Limited construction access and steep slopes present challenges to implementation projects at the park, though these can generally be overcome by advanced planning and construction mobilization cost premiums.

Removing sediment and vegetative growth around existing or proposed hand-carry launch sites will require dredging sediment material from the shoreline areas to create deeper pockets of water that prevent aquatic vegetative growth. Dredging is a common activity within the Genesee River basin but requires advanced planning, permitting, and adherence to a range of environmental controls.