LIVING SHORELINE TECHNIQUES IN THE BUFFALO-NIAGARA REGION
PRESENTATION AGENDA

• Organizational Overview
• Living Shoreline Program
  – Overview of Conditions in the River Greenway/Need
  – Program goals & components
  – Funding overview
• Site Overviews
  – Hyde Park
  – Ellicott Creek Park
  – Tifft Nature Preserve
  – Spicer Creek
  – Little Beaver Island
• Lessons Learned & Challenges
Buffalo Niagara Waterkeeper is a community-based nonprofit organization dedicated to protecting, and connecting people to, the water. We do this by cleaning up pollution, restoring fish and wildlife habitat, creating public access and enhancing educational opportunities.
Something about the importance of the Niagara River - biodiversity, flyway, etc.

Photo Credit: Beverly Seyler
NIAGARA RIVER GREENWAY SHORELINE CONDITION

- Upper River: 82.5% hard
- Total River: 24% hard
SHORELINE CONDITION
PRIMARY FACTORS AFFECTING SHORELINE CONDITION

- Land use
- Ice scour
- Wind
- Wakes
PRIMARY FACTORS AFFECTING SHORELINE CONDITION

- Water Level Fluctuations & Flow Reversals
OVERVIEW OF THE LIVING SHORELINES PROGRAM

PROGRAM GOALS

1. ADDRESS COMPLETE LAND-WATER INTERFACE
2. RESTORE SHORELINES TO A MORE NATURALIZED STATE
3. CREATE FUNCTIONAL, BEAUTIFUL, EDUCATIONAL SPACES
4. RECONNECT + RECREATE RESTORATIVE, RESILIENT INFRASTRUCTURE

The Buffalo Niagara WATERKEEPER® Living Shorelines Program aims to restore shoreline areas to their natural form – one that supports a more sustainable, resilient, and higher-functioning ecosystem. These efforts help to create functional, beautiful and healthy shorelines that improve water quality, enhance habitat, act as educational models, and enhance recreational access.
Living Shorelines
Source: The Shore Primer, Ray Ford

Retaining Wall
- Steep dropoff from land to water
- Erosion can occur behind the bulkhead
- Almost no wildlife along water's edge

Living Shoreline
- Gentle slope from land to water
- Wildlife has easy access to water from land
- Much more wildlife along water's edge
- Not only do Living Shorelines defend land against destructive waves, but they also provide crucial habitat for fish and wildlife.

Source: Partnership for the Delaware Estuary
PROCESS FOR EACH SITE

SITE SELECTION
- Desktop Analysis
- Site Visit and Data Collection
- Pre-construction Assessment

PRE DESIGN
- Access Agreements
- In-depth Site Assessment
  - Current Uses
  - Historic Significance
  - Watershed Context
  - Water Velocity
  - Flooding // Mean High Water
  - Substrates
  - Wind
  - Wildlife of Interest
  - Vegetation Cover
  - Soil Texture // Structure
  - Water Quality
  - Salvageable Materials
- Site Survey (Topography + Bathymetry)

DESIGN DEVELOPMENT
- Preliminary Design
- Refined Design
- Construction Documentation
  - Existing Conditions Plan
  - Demolition Plan
  - Site Preparation Plan
  - Layout + Materials Plan
  - Grading Plan
  - Planting Plans
  - Planting Schedule
  - Utility Plan
  - Site Details

CONSTRUCTION DOCUMENTATION CONT.
- Site Sections
- Plan Enlargement(s)
- As-Built Drawings

ANCILLARY MATERIALS
- Specifications
- Cost Estimate
- Shop Drawings
- Product Data
- Permitting Documents
- Construction Timeline Est.

BIDDING + CONSTRUCTION
- Secure Permits
- Assemble Bid Package
- Issue Advertisement
- Hold Pre-Bid Meeting
- Review and Award Bid
- Construction Over-Site
  - Field Fit Design
  - Reporting

POST CONSTRUCTION
- Management Plan
- Signage Production
- Presentation Materials
- Press Event
- Site Documentation
- Period of Establishment
- Monitoring
- Education and Outreach
  - Tours
  - Volunteer Clean-ups
  - Yelp
  - Etc.
<table>
<thead>
<tr>
<th>BNW Goals</th>
<th>Conditions measured</th>
<th>Questions answered</th>
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<tbody>
<tr>
<td>Complete land-water interface</td>
<td>% aquatic vegetation</td>
<td>Did the restoration practice increase the amount (i.e., length) of aquatic vegetation?</td>
</tr>
<tr>
<td>• In-water habitat creation and improvements</td>
<td>% stable streambanks/shoreline</td>
<td></td>
</tr>
<tr>
<td>• Land-water edge stabilization</td>
<td>% terrestrial woody canopy cover in various height classes</td>
<td></td>
</tr>
<tr>
<td>• Riparian protection, wildlife corridors, public access</td>
<td>(&gt;1 meter, 1-5 meters, &gt;5 meters)</td>
<td></td>
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<tr>
<td></td>
<td>% terrestrial herbaceous canopy cover</td>
<td></td>
</tr>
<tr>
<td>Restore shorelines to a more naturalized state</td>
<td>% hardened streambanks/shoreline</td>
<td>Did the restoration practice decrease the amount of hardened streambank/shoreline?</td>
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<tr>
<td>• Transition away from traditional hardened structures, such as bulkheads</td>
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<tr>
<td>• Employ bioengineering techniques to address bank stability and erosion</td>
<td></td>
<td></td>
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<tr>
<td>• Restore natural slope and utilize native/naturalized plants</td>
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</table>
OUTREACH: PUBLICATIONS

**BANKING ON THE FUTURE**

**WATERFRONT PROPERTIES**

**Western New York Guide to Native Plants for Your Garden**

BUFFALO NIAGARA WATERKEEPER®
FUNDING OVERVIEW

• New York Power Authority
  • Several funds established as part of the relicensing process for the New York Power Authority Niagara Power Project in Lewiston, NY.
  • Greenway Ecological Fund (GEF): Projects that create and support ecological enhancements within the Niagara Greenway.
  • Habitat Enhancement and Restoration Fund (HERF): Projects that address impacts from water level fluctuations, caused in part by Niagara Power Project operations

• U.S. EPA Great Lakes Restoration Initiative (GLRI)
  • Focus Area: Agricultural Watershed Management Implementation
<table>
<thead>
<tr>
<th>Site Name</th>
<th>Type</th>
<th>Funding</th>
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<tbody>
<tr>
<td>Hyde Park</td>
<td>Municipal Park</td>
<td>GESC</td>
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<tr>
<td>Spicer Creek</td>
<td>Golf Course</td>
<td>GLRI</td>
</tr>
<tr>
<td>Ellicott Creek Park</td>
<td>County Park</td>
<td>GESC</td>
</tr>
<tr>
<td>Little Beaver Island</td>
<td>State Park</td>
<td>HERF</td>
</tr>
<tr>
<td>Tifft Nature Preserve</td>
<td>Nature Preserve</td>
<td>GESC</td>
</tr>
</tbody>
</table>
HYDE PARK LAKE

**Location:** Niagara Falls, NY

**Landowner:** City of Niagara Falls

**Type:** Municipal Park

**Status:** Completed Spring 2017

**Construction Cost:** $118,700

**Design by:** BNW

**Construction by:** LDC Construction + Applied Ecological Services

**Funding by:** NYPA Greenway Ecological Fund (GEF)
EXISTING CONDITIONS
**DESIGN FEATURES**

- **NATIVE FLOWERS + GRASSES**
  Native plants attract pollinator species, support wildlife, and their deep root systems reduce erosion and filter harmful runoff before entering waterways.

- **IN-WATER HABITAT**
  Boulders, logs, and vegetation provide important resting, feeding, and spawning grounds for many aquatic species. These include fish, crayfish, and aquatic insects that are an important part of the food web. Wading and perching areas will now be available for waterbirds, too.

- **AQUATIC VEGETATION**
  In-water plant species provide important habitat for aquatic species like fish and amphibians. The plants will also protect shorelines from erosion, and improve water quality and clarity.

- **NATURAL SHORELINE PROTECTION**
  Boulders, cobbles, gravel, and recycled trees reduce erosion from wave action and ice scour.

- **LIVE BRANCH LAYERING**
  Cut branches of willow trees were salvaged from the site and placed along the shoreline. These cut branches will eventually grow into trees along the edge.

- **NESTING BOXES**
  Nesting boxes were designed and installed to attract beneficial wildlife species such as the long-eared bat, song birds, and wood ducks.

- **SHORELINE TREES**
  Shoreline trees were added to increase habitat for birds and the shade they cast over the water improves conditions for fish and amphibians. Deep root zones also help hold soils in place and prevent erosion.

- **FISH-SPAWNING AREA**
  Special design considerations were made to provide ideal conditions to promote warm-water fish species including bass, black crappie, perch, and pike.

- **CATTAILE MARSH**
  In addition to providing habitat, this cattail marsh is designed to treat and filter the runoff entering the lake from Robbins Drive, through a process called phytoremediation.
Existing Condition

CATTAIL MARSH
Existing Condition

WOODLAND GLADE / MEADOW
During Construction

WOODLAND GLADE / MEADOW
Post Construction: Year II

WOODLAND GLADE / MEADOW
Post Construction: Year III
Post Construction: Year III
HYDE PARK LAKE
QUESTIONS
ELLIOTT CREEK PARK

Location: Tonawanda, NY
Landowner: Erie County Parks
Type: County Park
Status: Completed Fall 2017
Construction Cost: $87,300
Design by: BNW
Construction by: Ecological Restoration Inc.
Funding by: NYPA Greenway Ecological Fund (GEF)
NIAGARA RIVER

NORTH TONAWANDA

TONAWANDA CREEK / HISTORIC ERIE CANAL

ELLICOTT CREEK PARK

ELLICOTT CREEK

FLOOD CONTROL BASIN

LIVING SHORELINE
EXISTING CONDITIONS & PROJECT PRIORITIES

INVASIVE SPECIES

SHORELINE EROSION

STORMWATER RUNOFF

CONSTRUCTED RIPARIAN ZONE
DESIGN STRATEGIES

- HABITAT COVES
- TURTLE NESTING BEACH
- PLANTING WRAPS
- BIORETENTION AREA
- VIEWING MOUND
- UPLAND MEADOW
CONSTRUCTED FEATURES

A | Habitat Coves
B | Turtle Nesting Beach
C | Bioretention Pool
D | Meadow & Mounds
Before Construction

HABITAT COVES
During Construction

HABITAT COVES
Post Construction: Year II

HABITAT COVES
Existing Condition

TURTLE NESTING BEACH
Post Construction: Year II

TURTLE NESTING BEACH
Existing Condition

BIORETENTION AREA
Post Construction: Year I

BIORETENTION AREA
Post Construction: Year II

BIORETENTION AREA
During Construction

MEADOW & MOUNDS
Post Construction: Year I

MEADOW & MOUNDS
Post Construction: Year II

MEADOW & MOUNDS
ELLIOTT CREEK PARK

QUESTIONS
TIFFT NATURE PRESERVE

**Location:** City of Buffalo, Lake Kirsty

**Landowner:** Buffalo Museum of Science

**Type:** Nature Preserve

**Status:** Under Construction – Fall 2019 Planting

**Construction Cost:** $382,365

**Design by:** BNW / assistance from Wendel Inc.

**Construction by:** Scott Lawn Yard Inc. + Applied Ecological Services

**Funding by:** NYPA Greenway Ecological Fund (GEF)
EXISTING CONDITIONS
BUFFALO NIAGARA WATERKEEPER

LIVING SHORELINES

RESTORATION AT TIFFT NATURE PRESERVE

The shoreline you see here today once looked very different. Before the living shoreline was constructed, a narrow strip of land at the water's edge was bare and dry. The land between lawn and water was exposed, making it susceptible to erosion. This exposed area was not only unattractive, but it also reduced the area available for wildlife to thrive.

But with the living shoreline project, we have transformed this area into a vibrant ecosystem that supports a wide variety of plants and animals. The project included the installation of new plant species that are native to the area, creating a more natural habitat for local wildlife.

The living shoreline project has also improved water quality by reducing runoff and pollutants that enter Lake Erie from stormwater. This helps to maintain the health of the lake and its surrounding ecosystem.

Living shoreline projects are not just about aesthetics. They are about creating healthy, biodiverse habitats that support a wide range of species. By restoring our shorelines, we are not only improving the environment, but we are also creating a better place for all of us to enjoy.

Living shorelines projects remove walls and other barriers, restore natural habitats, and protect shorelines with native plants and trees. These projects help to create a more natural and beautiful transition between land and water. It is estimated that 50% of the land in freshwater ecosystems in North America is covered in these vital water land transition areas. The living shoreline at Lake Erie demonstrates this "ribbon of life" along the water's edge, supporting numerous wildlife species, including birds, fish, amphibians, and beneficial insects.

Before:
- Turf lawn
- Eroding banks
- Limited aquatic habitat

Transition:
- Hardened shoreline

After:
- Upland zone
- Transition zone
- Aquatic zone

Upland Zone:
- Upland habitat
- Stable banks
- "Tree snag(s)"

Transition Zone:
- Gradual transition

Aquatic Zone:
- Emergent marsh
- Stone sill

Diverse Aquatic Habitat:
- Diverse aquatic habitat

Living shorelines are an important part of our efforts to protect and restore our waterways. By working together, we can create a healthier, more beautiful environment for all to enjoy.
QUESTIONS

TIFFT NATURE
PREERVE
QUESTIONS
SPICER CREEK at RIVER OAKS

**Location:** Grand Island NY, Spicer Creek

**Landowner:** River Oaks Golf Club

**Type:** Private Recreational Facility

**Status:** Completed Fall 2019

**Construction Cost:** $328,500

**Design by:** BNW / assistance from Wendel Inc.

**Construction by:** Ecological Restoration Inc.

**Funding by:** U.S. EPA Great Lakes Restoration Initiative (GLRI)
SPICER CREEK AT RIVER OAKS

RESIDENTIAL DEVELOPMENT

HOMEOWNERS ASSOCIATION

HOTEL

NIAGARA RIVER

TONAWANDA CREEK

PROJECT LOCATIONS
FORCES OF CHANGE
IN THE WATERSHED

Shorelines change naturally over time, often due to wind driven waves and ice movement. The perpetual motion dislodges soil particles which end up in our waterways. Under natural conditions this is a very slow process over a long period of time. However, human activities and land use changes have greatly accelerated erosion to damaging rates.

When the amount of soil exceeds the ability of water to transport it downstream, excess soil deposits onto the creekbed in a process called sedimentation. Excess soil can eventually clog the creekbed, destroying vital habitat for fish, insects, and other wildlife.

Additional impacts of accelerated erosion & sedimentation:
- Loss of Fertile Topsoil
- Flooding from Clogged Ditches, Culverts, & Storm Sewers
- Muddy or Turbid Water
- Decreased Biodiversity of Plant & Animal Life
- Clogged Ponds, Lakes, & Reservoirs
- Decreased Recreational Value & Use
- Structural Damage to Buildings & Roads

Before entering the creek, water travels under roads, through developed areas and across fields; picking up sediment and pollutants along the way.

Extreme streambank erosion indicates an unstable, unhealthy stream. The instability stems from a change in the stream’s shape, flow, or connectivity.

When creek channels are straightened, widened, or blocked; when shoreline vegetation is removed; or when land use changes contribute to increased runoff, erosion rates can increase.

IMPACT ZONES
Spicer Creek flows directly into the Niagara River which is a habitat for threatened species, an economic driver for outdoor recreation, and a vital source of drinking water.

Because these systems are connected, eroded soil from the creek can diminish water quality downstream.

Strengthening shorelines along Spicer Creek helps restore soil, plants, wildlife, and water quality throughout the watershed.

CAUSES OF CHANGE
Land Development | Wind, Wave & Ice Action | Stormwater Runoff

Exposed Soils
Bank Erosion
Sediment Deposition

Vegetation Removal
Drainage Channel Contamination
Polluted Discharge to Creek
Site Selection
Irrigation Pond Area: Re-Establishing Riparian Zones
Impact Assessments
Existing Conditions
Design Concept: Emergent Planting Shelves

- Carex lupilina
- Pontederia cordata
- Sagittaria rigida
- Justicia americana
- Lysimachia terrestris
- Iris versicolor

SPICER CREEK SHORELINE: PROPOSED
After Construction: Year I

Establishment
Existing Conditions
Feature Establishment
Lowland Floodplain Area: Channel Stabilization Techniques
Existing Conditions
Establishment – Coir Log & Live Stakes
Establishment – Coir Log & Live Stakes
Existing Conditions
Establishment
SPICER CREEK
QUESTIONS
**LITTLE BEAVER ISLAND**

- **Location:** Grand Island, NY – Niagara River
- **Landowner:** NYS Office of Parks, Recreation & Historic Preservation
- **Type:** State Park
- **Status:** Completed Summer 2019
- **Construction Cost:** $1,300,000
- **Design by:** Anchor QEA
- **Construction by:** LDC Construction / Applied Ecological Services
- **Funding by:** Habitat Enhancement and Restoration Fund (HERF)
High winds, waves, and boat wakes impact this shoreline continuously. These impacts cause accelerated erosion and a loss of critical shallow water habitat. To protect the shoreline, areas of severe erosion were identified and transformed into vibrant and self-sustaining habitat coves. Barrier rock reefs were installed in the water to lessen the wave energy and the calm water areas behind these structures created more suitable conditions for ecological restoration. Shoreline habitats can also be referred to as the ‘ribbon of life’ because it is estimated that 90 percent of all lake and river life is born, raised, or fed along the shorelines of water systems. The aquatic, transition, and upland zones are all critical components of a healthy shoreline. In addition to the creation of these three shoreline zones, woody debris such as logs and branches were added to enhance the in-water habitat. These features create resting and feeding grounds for water birds and fish, and are an important source of nutrients for microorganisms.
LITTLE BEAVER ISLAND
QUESTIONS
CHALLENGES & LESSONS LEARNED

- Site History
- Land Use Changes
- Surveying Needs (*i.e.* archeological, mussel)
- Permitting
- Water Level Fluctuations (*incl.* floods)
- Wildlife Damage
- Long-term Maintenance
THANK YOU

721 Main St.  |  Buffalo, NY  |  14203  |  @BNWaterkeeper.org  |  (716) 852 - 7483