Lake Erie Green Infrastructure Project
Final Report

Project Title: Erie County Beach Pollution Mitigation Project

Funded By: US EPA Great Lakes Restoration Initiative, GL00E02418

Project Timeline: 10/1/2018-5/31/2020 extended to 6/30/2022

Project Description:
Erie County Soil and Water Conservation District (District) in cooperation with the Lake Erie Watershed Protection Alliance (LEWPA) assisted the Town of Evans and the City of Dunkirk to install green infrastructure projects within two separate parks to reduce stormwater runoff and improve nearshore water quality in Lake Erie. Ecology and Environment Engineering and Geology PC completed all project design for this project and assisted with finalizing plans, preparation of bid documents and construction oversite. Project site #1 is located at the Lake Erie Beach Park, Town of Evans. Grant funds constructed a vegetated swale and two rain gardens at this site. Project site #2 is located at the Point Gratiot Park, City of Dunkirk. Grant funds removed an asphalt path and constructed three rain gardens acting in series as well as the installation of two vegetated swales.

Lake Erie Beach, South Rain Garden

Background:
During the summer, public beaches on the eastern shore of Lake Erie are regularly closed to bathing after moderate rain events due to water quality issues. In 2017, Ecology and Environment Engineering (E&E) worked with the New York State Department of Environmental Conservation (NYSDEC) and New York State Office of General Services (NYSOGS) through the NYS Environmental Protection Fund to design green infrastructure features at two municipally owned and operated public beaches with a history of beach closures. The overall intent of the project was to implement small-scale practices that take a step toward addressing the water quality issues at beaches on the eastern shore of Lake Erie.

Lake Erie Beach Park (Town of Evans, NY) and Point Gratiot Park (City of Dunkirk, NY) are located within financially distressed municipalities that struggle with beach closures due to poor water quality that is exacerbated by outdated drainage infrastructure. To assess the suitability of the parks for green infrastructure implementation, E & E, NYSDEC, and NYSOGS met with the local municipal representatives at each site to determine potential projects to reduce surface runoff to the lake.

E&E assembled a team of engineers, landscape architects, and scientists to develop designs for the parks. E&E designed preliminary green infrastructure for these sites that use existing site features and infrastructure to reduce storm water runoff within the two parks. The preliminary designs were presented to municipal representatives to explain the goals of the designs and to solicit feedback from the municipalities. E&E then incorporated comments provided by the municipalities into the final designs.

Through this project the Erie County Soil and Water Conservation District in partnership with the Lake Erie Watershed Protection Alliance utilized the design work that was completed by E&E to assist these two municipalities to construct the planned green infrastructure projects that were installed. By constructing these projects, we believe that furthers LEWPA's mission to "foster collaboration and partnerships within the watershed to address regional water quality and quantity concerns and in doing so, protect and enhance our Lake Erie resource." LEWPA also strives to support federal and state restoration initiatives such as the Great Lakes Restoration Initiative and the Great Lake Action Agenda. We believe this project directly supported the GLRI focus area of addressing nonpoint source pollution impacts on near shore health through the reduction of untreated urban runoff.

Project Site #1 - Lake Erie Beach Plan Summary
Four areas at Lake Erie Beach Park were originally identified as potential locations for green infrastructure implementation to decrease storm water loading to the beach area and to nearby Muddy Creek. Three of these locations were deemed to be suitable for green infrastructure designs: a vegetated swale and two rain gardens. The vegetated swale is designed to achieve the following: increase storm water residence time, increase storm water infiltration to the native soils, improve the quality of water discharged to Muddy Creek, and improve the aesthetic value of the existing swale adjacent to the town parking lot. The rain gardens are designed to achieve the following: increase the storm water collection area; increase storm water infiltration to the native soils; decrease the quantity of sheet flow runoff to Muddy Creek; and add to the aesthetic value of the park. The fourth potential area identified (a storm water discharge pipe at the north end of the site) was deemed to be out of the scale of this project due to the potential volume of

water that must be handled and the proximity of this feature to neighboring properties and existing structures at the park.

Each of the three green infrastructure features includes native grasses, plantings, and shrubs. These promote biodiversity, improve aesthetics, increase infiltration rates as the root systems develop, and improve water quality through various mechanisms. These grasses, plantings, and shrubs were selected specifically to achieve these goals, and their placement in the planting plan is based on the tolerances of each individual plant.

Project Site #2- Point Gratiot Park Plan Summary

Four areas at Point Gratiot Park were identified as potential locations for green infrastructure implementation to decrease storm water loading to the beach area. Three of these locations were deemed to be suitable for green infrastructure designs: removal of the broken asphalt path along the lake shore with installation of three rain gardens acting in series; installation of a vegetated swale along W. Oak St.; and installation of a vegetated swale/rain garden along Park Drive. The vegetated swales are designed to achieve the following: increase storm water residence time, increase storm water infiltration to native soils, decrease peak storm water flow velocity, decrease storm water discharge to the beach, improve drainage from adjacent recreational areas, and improve the aesthetic value of the park. Removal of the asphalt path and installation of the rain gardens are designed to achieve the following: decrease impervious area where storm water runoff is generated, create collection and infiltration points for storm water, decrease storm water discharge to the beach, create overflow areas for the W. Oak St. vegetated swale, and improve the aesthetic value of the park. The fourth potential area identified (the parking lot adjacent to Park Drive) was evaluated to determine if permeable pavement installation would be effective. It was determined that permeable pavement in this area would require intensive maintenance and would offer limited benefits in terms of storm water runoff generation.

Each of the green infrastructure features includes native grasses, plantings, and shrubs. These promote biodiversity, improve aesthetics, increase infiltration rates as the root systems develop, and improve water quality through various mechanisms. These grasses, plantings, and shrubs were selected specifically to achieve these goals, and their placement in the planting plan is based on the tolerances of each individual plant.

Approach:

The District initiated a contract with E&E engineering to compile final project drawings and complete the preparation of bid documents for both project sites. The District and E&E engineers meet on site a number of times to review the project plans, the overall intent of the design and all components to be constructed. The District was to act as the project lead, oversee all aspects of construction and rely on E&E engineers on an as needed basis only for construction support services.

After review with E&E engineers and completion of the final bid documents a site showing for qualified contractors was scheduled for August 19th, 2019. This site showing announcement was emailed and/or faxed to potential contractors on the District maintained contractor list.

Additional potential contractors know to work with the Chautauqua County Soil and Water Conservation District were also notified via email and/or fax. A notice to bidders' advertisement was placed in the District legal newspaper publication, the East Aurora Advertiser, on August 15th, 2019. The notice identified that type of construction activity, site showing date, bid due date and that minority and woman owned businesses were encouraged to submit bids. The site showing was held on the 19th and both site construction activities were fully reviewed as it was decided it would be best to let the contract to build both sites to one contractor. Three bids were received on September 4th, 2019, where the apparent low bid was selected to proceed to contracting.

Construction contracts, insurances and bonding necessary to start construction activities was completed in September 2019 with the low bid contractor. A pre-construction meeting with District, contractor, municipal and engineering representatives took place on October 3rd, 2019. Construction of the Lake Erie Beach project site began on October 14th, 2019. Construction activities proceeded relatively quickly as the construction season was winding down and all parties involved wanted to complete at least the Lake Erie Beach project site prior to winter weather setting in and ending the construction season. The Point Gratiot Park project site construct could easily be delayed until the 2020 construction season as weather dictated. Constriction on the Lake Erie Beach site was essentially complete by the end of November 2019 including two rain gardens and a vegetated swale when the area was hit with a high wind event and a seiche occurred in the lake. This high wind, high wave event severely damaged one rain garden and the vegetated swale by removing topsoil and plant materials and depositing woody debris in the depressions.

11/27/2019 storm event damage

As the Lake Erie Beach project site damage assessment was being conducted the contractor's construction equipment was mobilized to the Point Gratiot Park project site. Demolition and removal of the asphalt bike/walking path along the lake shore started construction activities at this site. Wet fall weather and approaching snow in early December halted construction activities for the season. It was decided that construction would start up in the Spring of 2020 at the Point Gratiot project site then return to the Lake Erie Beach project site for storm damage repair. Construction activities resumed in late May 2020 and carried on through the end of June 2020. Since we were late in the planting season and warm summer weather had arrived it was

decided that final planting would be delayed until the fall. Final planting and additional spot seeding was completed in late September and October of 2020. As project work was completed and final paperwork was being compiled when the area was again hit with a second high wind storm event and subsequent Lake Erie seiche.



11/15/2020 storm event damage

Lake Erie Beach project site took the brunt of the damage from the second seiche event and was again cleaned up in the spring of 2021. It was decided to assess what plants made it through the cleanup efforts and replace in the fall of 2021. Planting was delayed due to availability in the fall. This turned out to be a good thing as the third seiche event occurred in December of 2021.



12/11/2021 storm event damage

Although not a part of this grant project or the construction contract Town of Evans forces assisted with woody debris cleanup efforts and offsite disposal in the spring of 2022. All remaining grant funds available were used to reshape and grade one rain garden and a vegetated swale at the Lake Erie Beach site for a second time. In addition, two rain gardens at the Point Gratiot Park site were reshaped and graded as well as select plantings throughout the two vegetated swales. All construction activities were completed prior to June 30th, 2022 extended grant end date.

Results:
Throughout the entire grant contract period Lake Erie experienced cyclically high water levels due to higher than average precipitation throughout the Great Lakes watershed. A total of three separate high wind (60mph plus) storm events that occurred in the fall of 2019, 2020 and 2021 caused significant damage. These events caused significant construction delays, numerous site clean ups and rebuilding/ replanting efforts. Despite these construction problems in the end all green infrastructure designed grant deliverables were met. This included a vegetated swale, two rain gardens and plantings at the Lake Erie Beach project site. These constructed green infrastructure practices will collect and treat and estimated 1.47 million gallons of stormwater annually. The Point Gratiot Park project site green infrastructure measures consisted of removal of the broken asphalt path along the lake shore with installation of three rain gardens acting in series; installation of a vegetated swale along W. Oak St.; and installation of a vegetated swale/rain garden along Park Drive. These constructed green infrastructure practices will collect and treat and estimated 1.42 million gallons of stormwater annually. These treated stormwater estimates were calculated using the US EPA National Stormwater Calculator (version 3.4.0).

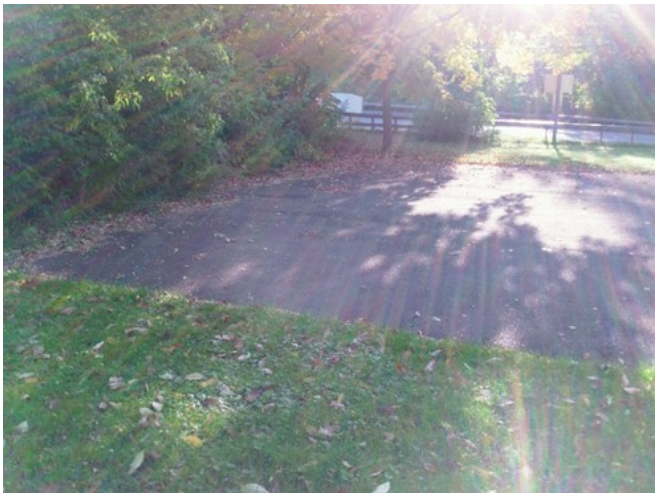
Post Construction Monitoring and Maintenance:
Town officials in both the Town of Evans and the City of Dunkirk had been fully involved with the Lake Erie Beach green infrastructure project implementation in their respective jurisdictions. Municipal and city parks crews will assume overall operation and maintenance responsibilities of the green infrastructure projects constructed. Maintenance tasks will mainly entail monitoring changes after significant storm events, maintaining mowing restrictions and removal of leaf litter, woody debris and dead organic material at least annually. The town or city may call upon the Erie County Soil and Water Conservation District for technical assistance and guidance should any questions or concerns arise with their operation and maintenance responsibilities.

Two specific additional item that will be monitored by all parties involved with this project include future seiche events and plant replacements. Of particular concern has been the almost annual fall Lake Erie seiche and subsequent damage to primarily the North rain garden and vegetated bioswale at the Lake Erie Beach Park site in the Town of Evans. These two structures were the first to be damaged in all storm events and the most heavily damaged throughout all storm event during the grant timeline. Should another seiche event occur and damage either of these components it would be advisable not to rebuild at the same location. It is clear that the engineer's who completed the design at this location did not account for extended high lake levels and the potential for high winds and seiche events; or were limited by financial constraints. It is also a concern that due to the lateness of completing the last round of restoration a proper one year of plant monitoring was not completed. Plant mortality is a possibility and may be necessary in the spring of 2023.

Pre and Post Construction Documentation:

Lake Erie Beach

Lake Erie Beach, South Rain Garden—Before (parking)



Lake Erie Beach, South Rain Garden—During construction (pavement cut and removal)

Lake Erie Beach, South Rain Garden—After (no germination)

Lake Erie Beach, Rain Garden / Vegetated Swale — Plant materials

Lake Erie Beach, South Rain Garden—Final

Select Plants

Lake Erie Beach

Lake Erie Beach, North Rain Garden—Before

Lake Erie Beach, North Rain Garden—After (no germination)

Lake Erie Beach, North Rain Garden— Storm damage/debris from 3rd seiche event 12/10/21

Lake Erie Beach, North Rain Garden— During construction, grading

Lake Erie Beach, North Rain Garden— Storm damage/debris from 1st seiche event 11/27/19

Lake Erie Beach, North Rain Garden—After 3rd restoration

Lake Erie Beach

Lake Erie Beach, Vegetated Swale—Before

Lake Erie Beach, Vegetated Swale—During construction

Lake Erie Beach, Vegetated Swale—During construction

Lake Erie Beach, Vegetated Swale Planting

Lake Erie Beach, Vegetated Swale—After (no germination)

Lake Erie Beach, Vegetated Swale After, early season growth

Lake Erie Beach

Lake Erie Beach, Vegetated Swale
After, early season growth

Lake Erie Beach, Vegetated Swale — Storm damage / debris from 2nd seiche event 11/15/20

Lake Erie Beach, Vegetated Swale —
After second restoration

Lake Erie Beach, Vegetated Swale—
After second restoration

Lake Erie Beach, Vegetated
Swale—Final

Select Plants

Point Gratiot Park

Point Gratiot Park, Paved Path
— Before removal

Point Gratiot Park, Paved Path
- After removal—topsoiling

Point Gratiot Park, Rain Garden —
Necessary infrastructure upgrades

Point Gratiot Park, Rain Garden —
Necessary infrastructure upgrades

Point Gratiot Park, South Rain Garden —
Necessary infrastructure upgrades

Point Gratiot Park, South Rain Garden —
Necessary infrastructure upgrades

Point Gratiot Park

Point Gratiot Park, North Rain Garden — During construction

Point Gratiot Park, South Rain Garden — During construction

Point Gratiot Park, North Rain Garden — After (before seeding)

Point Gratiot Park, Central Rain Garden — After (before seeding)

Point Gratiot Park, North Rain Garden — Final (early growth)

Point Gratiot Park, South Rain Garden — Final

Point Gratiot Park

West Oak Street Vegetated Swale—Before

(facing east)

(facing west)

West Oak Street, Vegetated Swale —
During construction, grading

West Oak Street, Vegetated Swale —
During construction, grading

West Oak Street, Vegetated Swale— After
(minimal growth facing west)

West Oak Street, Vegetated
Swale— Final (facing east)

West Oak Street, Vegetated
Swale— Final (facing west)

Point Gratiot Park

Park Drive — Before

Park Drive, Dead and dying Ash trees marked for removal

Park Drive, Vegetated Swale/ Rain Garden—During construction

Park Drive Vegetated Swale/ Rain Garden—During construction

Park Drive Vegetated Swale/ Rain Garden—During construction

Park Drive Vegetated Swale / Rain Garden—After (minimal growth)

Park Drive Vegetated Swale / Rain Garden—Final