

FINAL REPORT

Door County Soil & Water Conservation Department-
Implementation of BMP's at Beaches to Improve Water Quality

GRANT NUMBER:

GL-00E00837-0

Amendment Assistance Number:

GL-00E00837-1

REPORTING PERIOD COVERED:

August 1, 2011 – December 31, 2015

PRINCIPAL INVESTIGATOR:

Door County Soil & Water Conservation Department

Greg Coulthurst

421 Nebraska Street

Sturgeon Bay, WI 54235

MARCH 29, 2016

I. Introduction

The Door County Soil and Water Department (SWCD) received a Great Lakes Restoration Initiative Grant (GL-00E00837-0) in 2011 and was subsequently awarded a one year extension in September 2014. The purpose of this project was to offer municipalities a cost-share incentive for the construction of green infrastructure and or best management practices (BMPs), to treat storm water runoff and to improve water quality at several Door County beaches, and ultimately reduce beach closures and advisories. This is a final report to describe the work accomplished under this Assistance Agreement No. GL-00E00837-0 and Amendment No. GL-00E00837-1.

II. Background

Earlier research (2003-2007) conducted by SWCD, Door County Public Health Department (DCPHD), and the University of Wisconsin-Oshkosh (UWO) showed that storm water discharge and/or run off increases *E. coli* counts in beach water during and after rain events. Storm water discharge during and after rain events is one of the clear sources of *E. coli* contamination in beach water throughout the county (*Door County Beach Contamination Source Identification Final Report 2006-2007, Page 92*). This report will summarize the efforts of a second round of funding from the Great Lakes Restoration Initiative (GLRI) to install BMP's and address the pollutant sources and causes of beach closures at Door County Beaches.

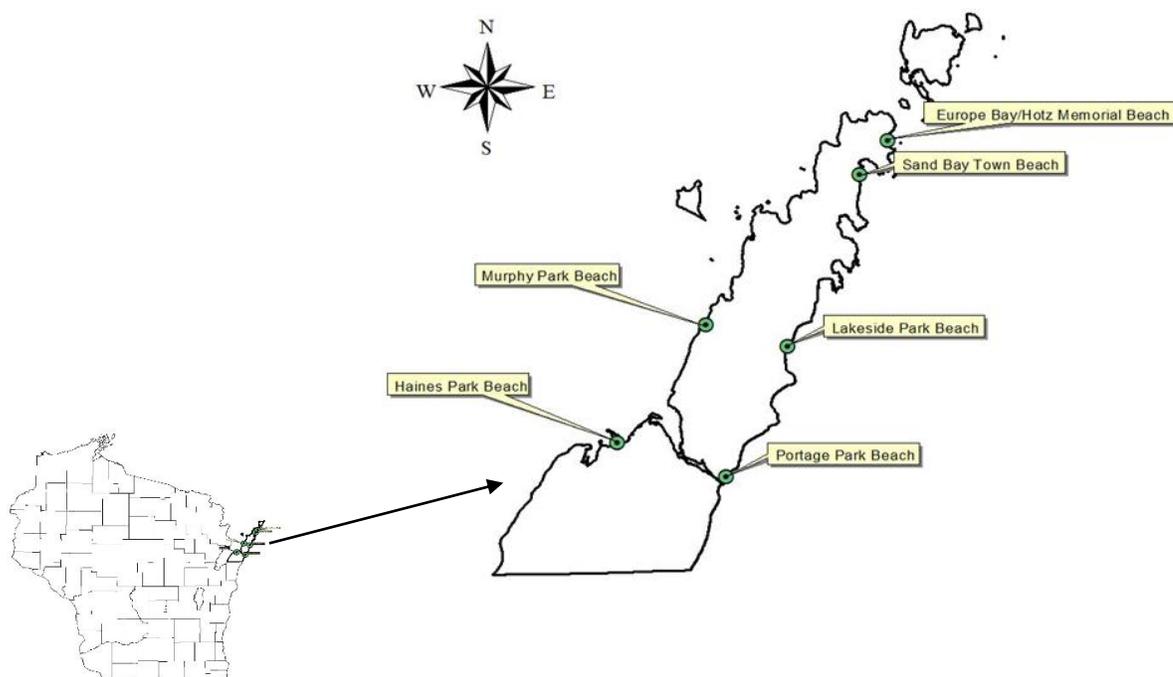
Prior activities to this GLRI grant and the aforementioned GLRI grant, (GL-00E00510-0) implemented in 2010 through 2012, the SWCD began a Beach Contamination Reduction project. The earlier research and investigations focused on what, if anything could be done at Door County beaches to minimize the storm water discharge and runoff. Made possible by Wisconsin Coastal Management Program (WCMP) funding, the SWCD was able to work with an engineering firm (Miller Engineers & Scientists) and nine municipalities, covering eleven beaches, to design preliminary and final design plans for these beaches. Because there were limited regulations and funding available for addressing storm water runoff and beach water quality, especially for beaches located within smaller municipalities where resources, funding, and expertise were and are limited. It's for these reasons; the SWCD again applied for an additional GLRI grant to help with costs to actually implement the designs at beaches that have yet to implement BMP's. This project again builds upon the previous GLRI grant (GL-00E00510-0) that provided municipalities with funding to implement BMPs at their beaches to reduce storm water contamination. These municipalities included The Town of Baileys Harbor - Anclam Park Beach, The City of Sturgeon Bay - Otumba Park Beach, and The Door County Parks Department -Baileys Harbor Ridges Beach

This project was to first focus implementation of BMP's on the four remaining high priority beaches; (Town of Gibraltar – Fish Creek Beach, Town of Jacksonport – Lakeside Park Beach, the Village of Ephraim –Village Beach, and County of Door, Parks Department - Murphy Park Beach. Of these high priority municipalities two municipalities entered into cost share assistance agreements. BMP's were thus installed at Lakeside Park Beach in the Town of Jacksonport and at Door County Parks Department's Murphy Park Beach. The remaining cost share assistance funds

were then offered to 5 medium – priority beaches within the County. Medium - priority beaches included: Town of Nasewaupée –Haines Park Beach, Town of Liberty Grove – Sand Bay Town Beach and Europe Bay/Hotz Memorial Park Beach, Door County Land Trust – Sturgeon Bay Recreational Canal Beach, and The Town of Sturgeon Bay – Portage Park Beach. Cost share agreements with the Town of Nasewaupée, Town of Sturgeon Bay and the Town of Liberty Grove resulted in the completion of beach remediation BMP’s at Haines Park, Portage Park, Europe Bay/Hotz Memorial Park, and Portage Park. A more detailed explanation of prior and post conditions for each beach will be described in this final report.

III. *Project Location Map*

Door County Beach Water Quality Implementation Projects



IV. *GLRI Work Plan and Deliverables*

Murphy Park Beach – Door County Parks Department

Location: Murphy Park Beach is located on the Green Bay side of the Door Peninsula in the Town of Egg Harbor and is owned and managed by the Door County Parks Department. (HUC code: 04030102, Latitude 45.0153 & Longitude - 87.3325)

Background: Murphy Park Beach is one of two high priority beaches that installed Best Management Practices (BMP's) to abate pollutant sources and reduce beach closures. The physical characteristics of Murphy Park Beach includes: impervious runoff from a drive way, parking lot, concrete pier, and roof runoff from a pit toilet; an intermittent stream discharging surface water runoff and storm water runoff in the midst of the beach area; and numerous ground water seeps which have historically eroded the beach during high ground water periods especially in the spring of each year. Aside from storm water related pollutants other potential sources of *E. coli* in the immediate vicinity included avian waste in particular goose and gulls, cladophera, and neighboring properties with private on site waste treatment systems. The project at Murphy Park Beach focused on the sources and issues that could be immediately addressed on site which included the storm water runoff, waterfowl abatement and groundwater seeps.

Implementation: The construction of BMP's was largely completed in October 2014 with the cord walks being installed in the summer of 2015. BMP's installed included: a ground water tile line and Infiltration basin system to address larger runoff events; a series of swales and bio filters to address parking lot runoff; beach nourishment with coarse grained sand for a higher and drier beach; and plantings of native beach grass to promote greater infiltration rates, nutrient uptake and filtering. In an effort to discourage Canadian geese from wandering up the beach to feed on the upland lawn areas the Native dune grass plantings were established on two to three foot high shallow dunes for the purpose of shielding the line of site for the geese. In addition, to maintain these plantings, curved cord walk paths were installed to allow the public to access the beach while maintaining a shielded line of site from the water again to deter geese movement.

Cost Summaries:

Estimated Cost: \$246,612

Actual Cost: \$239,123.41

GLRI actual cost: \$164,487.41

Actual Match Door County Parks cost: \$74,636

Water testing summaries: From 2003 to the end of the beach season in 2014 (12 years) and prior to construction, Murphy Park Beach experienced 31 advisories and 16 closures due to elevated levels of *E. coli* bacterial levels. In 2015 there were on 2 advisories and one closure out of 57 water samples. **Note: All of the closures and advisories were solely based on *E. coli* levels and do not include other unmeasured pollutants such as heavy metals or nutrients from storm water runoff.** The Door County SWCD in partnership with the Door County Public Health Department and UW Oshkosh will continue to promote monitoring of Murphy Park beach to monitor the success of implemented BMP's for all potential contaminants. The following link will provide more detailed information on test levels and the number of results during each season: <http://www.wibeaches.us/apex/f?p=181:11:0::NO:RP>

Highlights, obstacles, and lessons learned:

- This was the largest project that Door County SWCD coordinated and the permitting process for the federal US Army Corps of Engineers permit took several months for review and approval.
- During the course of installing this project Lake Michigan water levels rebounded significantly approximately 3 feet from record lows in 2012 to 2015, reducing the amount of sand nourishment that was going to be placed at the beach.
- Ground water seeps eroding the sand was not observed in 2015.
- The beach nourishment and curved access cord walks have noticeably limited the goose migration to the upland lawn areas, however when the beach is unoccupied (bad weather or off beach months) the geese will congregate on the beach area below the native dune grass.
- Gulls continue to congregate on the pier leaving the pier at times coated with fecal matter. Future avian abatement on the pier is evident.
- Several positive comments have made by the general public and local County leaders.
- BMP's installed, as designed, are preventing contaminants other than *E. coli* from directly impacting the beach, however only *E. coli* continues to be the focus of monitoring efforts.

Photos: Included in this report is a subset of the photos taken, see below for a drop box link and additional photos.

Pre-Construction Photos:





Post Construction Photos







Complete Plans, Photos, and Cost Containment:

Murphy Park Project Drop Box link:

<https://www.dropbox.com/sh/e2ohl8y62om06q9/AACs1TmACsTwp8AtTUZm6SEa?dl=0>

Lakeside Park Beach – Town of Jacksonport

Location: Lakeside Park Beach is located on the Lake Michigan side of the Door Peninsula in the Town of Jacksonport and is owned and managed by the Town of Jacksonport. (HUC code: 04030102, Latitude 44.9779 & Longitude -87.1833)

Background: Lakeside Park Beach is also one of two high priority beaches that installed Best Management Practices (BMP's) to abate pollutant sources and reduce beach closures. The physical characteristics of Lakeside Park Beach include impervious runoff from a drive way, parking lot, roof runoff from a pit toilet, and significant storm water contribution from an out fall pipe located just north of beach. This site has historically been impacted by storm water events and was likely the major causes for beach closures at Lakeside Park Beach. In fact in the years of 2009 through 2011 many closures were preemptive due to rainfall events. Aside from storm water related pollutants other potential sources of *E. coli* in the immediate vicinity included avian waste in particular goose and gulls, cladophera, and neighboring properties with private on site waste treatment systems. The project at Lakeside Park Beach focused on the

sources and issues that could be immediately addressed on site, which included the storm water runoff and waterfowl abatement.

Implementation: The construction of BMP's were completed in October 2014 with the signage being installed in 2015. BMP's installed included: a storm water infiltration trench system to infiltrate smaller storm water events with only the largest events by-passing after capacity is obtained; beach nourishment of a coarse grained sand for a higher and drier beach; and plantings of native beach grass to promote greater infiltration rates, nutrient uptake and filtering. In an effort to discourage Canadian geese from wandering up the beach to feed on the upland lawn areas the native dune grass plantings were established on two to three foot high shallow dunes for the purpose of shielding the line of site for the geese. In addition, to maintain these plantings, curved cord walk paths were installed to allow the public to access the beach while maintaining a shielded line of site from the water to deter geese.

Cost Summaries:

Estimated Cost: \$120,000

Actual Cost: \$121,595

GLRI actual cost: \$120,000

Actual Match Town of Jacksonport cost: \$1,595

Water testing summaries: From 2003 to the end of the beach season in 2014 (12 years) and prior to construction, Lakeside Park Beach experienced 27 advisories and 26 closures due to elevated levels of *E. coli* bacterial levels. **Note 17 of these closures were preemptive closures based on rainfall events due to the history of closures associated with larger rainfall events.** In 2015 there were on 0 advisories and one closure out of 29 water samples. **Note: At this beach all closures and advisories were solely based on *E. coli* levels present or expected *E. coli* levels due to heavy rainfall events. Closures were not associated with other unmeasured pollutants such as heavy metals or nutrients from storm water runoff.** The Door County SWCD in partnership with the Door County Public Health Department and UW Oshkosh will continue to promote monitoring of Lakeside Park beach to monitor the success of implemented BMP's for all potential contaminants. The following link will provide more detailed information on test levels and the number of results during each season: <http://www.wibeaches.us/apex/f?p=181:11:0::NO:RP>

Highlights, obstacles, and lessons learned:

- This project was scaled down slightly from the original plans that include expanding the beach northward in front of the adjacent private landowner to an existing paved and public access to the water. The town wanted to modify this access for water rescue and fire truck filling purposes. When the adjacent landowner declined to participate the rescue access was moved to the north boundary of the beach nourishment. When the water

levels came up approximately three feet from the record lows in 2012, the beach experienced some erosion and rescue vehicle access to Lake Michigan compromised. As a result the Town proceeded with modifying the existing access that had a sheet piling and steep drop off to a gradual ramp cut into or out of the existing pier.

- As mentioned above higher lake levels have caused some beach erosion and additional nourishment maybe needed in future years.
- Several positive comments have been made by the general public and local County leaders.
- Maintaining any type of plastic fence to allow beach grass to thoroughly establish has been challenging, a more durable snow fence should be considered unless the beach is more sheltered.
- BMP's installed, as designed, are preventing contaminants other than *E. coli* from directly impacting the beach, however only *E. coli* continues to be the focus of monitoring efforts.

Photos: Included in this report is a subset of the photos taken, see below for a drop box link and additional photos.

Pre-Construction Photos:





Post Construction Photos





Complete Plans, Photos, and Cost Containment:

Lakeside Park Beach Project Drop Box link:

<https://www.dropbox.com/sh/ta452ocgzy9w4qg/AADz4tStXqdUT9htX06NuAbAa?dl=0>

Europe Bay/Hotz Memorial Park Beach – Town of Liberty Grove

Location: Europe Bay/Hotz Memorial Park Beach is located on the Lake Michigan side of the Door Peninsula in the Town of Liberty Grove and is owned and managed by the Town of Liberty Grove. (HUC code: 04030102, Latitude 45.2594 & Longitude -86.9850)

Background: Europe Bay/Hotz Memorial Park Beach is one of four medium priority beaches that installed Best Management Practices (BMP's) to abate pollutant sources and reduce beach closures. The physical characteristics of Europe Bay/Hotz memorial Park Beach include impervious runoff from a drive way, parking lot, and roof runoff from a pit toilet. This site has a history of having no closures and only a handful of advisories. The most significant source of contaminants that could be addressed was the storm water runoff from the road and parking area. Aside from storm water related pollutants other potential sources of *E. coli* in the immediate vicinity included cladophera, the pit toilets on the property, and neighboring properties with private on site waste treatment systems. The project at Europe Bay/Hotz Memorial Park Beach focused on the sources and issues that could be immediately addressed on site which included the storm water runoff from the road and parking area.

Implementation: The construction of BMP's were completed in June 2014. The handicap accessible boardwalk and viewing plat were completed in October 2014 and the signage was installed in 2015. BMP's installed included: a storm water Bio filter infiltration system to infiltrate storm water that previously discharged directly on the beach and beach nourishment of a coarse grained sand and native beach grass within the bio filter to promote greater infiltration rates, provide a higher and drier beach, and to improve nutrient uptake and filtering. In addition a handicap accessible board walk and viewing platform were installed as the Town of Liberty Grove, through numerous Town Hall meetings, approved the project with a condition that a handicap access and viewing platform were included.

Cost Summaries:

Estimated Cost: \$49,521

Actual Cost: \$41,032.71

GLRI actual cost: \$41,032.71

Water testing summaries: From 2003 to June 27, 2014 (~11 1/2 years) and prior to construction, Europe Bay/Hotz Memorial Park Beach experienced 4 advisories and 0 closures due to elevated levels of *E. coli* bacterial levels. After June 27, 2014 and in all of 2015 there were 2 advisories and 0 closures out of 48 water samples during this period. **Note: At this beach all advisories are solely based on *E. coli* levels present. Closures were not associated with other unmeasured pollutants such as heavy metals or nutrients from storm water runoff.** The Door County SWCD in partnership with the Door County Public Health Department and UW Oshkosh will continue to promote monitoring of Europe Bay/Hotz Memorial Park beach to monitor the success of implemented BMP's for all potential contaminants. The following link will provide more detailed information on test levels and the number of results during each season: <http://www.wibeaches.us/apex/f?p=181:11:0::NO:RP>

Highlights, obstacles, and lessons learned:

- This project incorporated, upon the Town of Liberty Groves condition to participate, a handicap accessible boardwalk and viewing platform.
- Avian impacts at this beach is minimal due to the beach being bordered primarily by woodland vegetation versus a manicured lawn.
- Several people have expressed their approval of the benched viewing platform, and have been observed reading a book and enjoying the solitude of this beach.
- BMP's installed, as designed, are preventing contaminants other than *E. coli* from directly impacting the beach, however only *E. coli* continues to be the focus of monitoring efforts.

Photos: Included in this report is a subset of the photos taken, see below for a drop box link and additional photos.

Pre-Construction Photos:





Post Construction Photos:







Complete Plans, Photos, and Cost Containment:

Europe Bay/Hotz Memorial Park Beach Project Drop Box link:

https://www.dropbox.com/sh/rzkjp5wt2oqhifa/AADpms_rCeUqxaJ3umPFpKnOa?dl=0

Sand Bay Town Beach – Town of Liberty Grove

Location: Sand Bay Town Beach is located on the Lake Michigan side of the Door Peninsula in the Town of Liberty Grove and is owned and managed by the Town of Liberty Grove. (HUC code: 04030102, Latitude 45.2122 & Longitude - 87.0401)

Background: Sand Bay Town Beach is one of four medium priority beaches that installed Best Management Practices (BMP's) to abate pollutant sources and reduce beach closures. The physical characteristics of Sand Bay Town Beach include impervious runoff from a drive way, parking lot, roof runoff from a pit toilet, an intermittent stream discharging surface water runoff and storm water runoff on the north end of the beach area; and numerous ground water seeps which have historically eroded the beach during high ground water periods especially in the spring of each year. This site also has a history of having no closures and only a handful of advisories. The most significant contaminants that could be addressed were the storm water runoff from the road and parking area along with avian, or more specifically Canadian Geese. Aside from storm water and avian related pollutants other potential sources of *E. coli* in the immediate vicinity included cladophera, the pit toilets on the property, and neighboring properties with private on site waste treatment systems. The project at Sand Bay Town Beach focused on the sources and issues that could be immediately addressed on site which included the storm water runoff from the road and parking area, avian waste abatement, and the groundwater seeps that were eroding the beach.

Implementation: The construction of BMP's were completed in June 2014. The handicap accessible boardwalk and viewing plat were completed in October 2014 along with the cord walks. The signage was installed in the early summer of 2015. BMP's installed included: a tile system to reduce groundwater seeps eroding the beach, beach nourishment of a coarse grained sand and native beach grass for a higher and drier beach and to improve nutrient uptake and filtering. In addition two cord walks and a handicap accessible board walk with viewing platform were installed, as the Town of Liberty Grove, through numerous Town Hall meetings, approved the project with a condition that a handicap access and viewing platform were included.

Cost Summaries:

Estimated Cost: \$82,684

Actual Cost: \$72,716.22

GLRI actual cost: \$72,716.22

Water testing summaries: From 2003 to June 27, 2014 (~11 1/2 years) and prior to construction, Sand Bay Town Beach experienced 2 advisories and 0 closures due to elevated levels of *E. coli* bacterial levels. After June 27, 2014 and in all of 2015 there were 2 advisories and 0 closures out of 45 water samples taken during this period. **Note: At this beach all advisories are solely based on *E. coli* levels present. Closures were not associated with other unmeasured pollutants such as heavy metals or nutrients from storm water runoff.** The Door County SWCD in partnership with the Door County Public Health Department and UW Oshkosh will continue to promote monitoring of Sand Bay Town beach to monitor the success of implemented BMP's for all potential contaminants. The following link will provide more detailed information on test levels and the number of results during each season:

<http://www.wibeaches.us/apex/f?p=181:11:0::NO:RP>

Highlights, obstacles, and lessons learned:

- This project incorporated, upon the Town of Liberty Groves condition to participate, a handicap accessible boardwalk and viewing platform.
- Ground water seeps eroding the sand was not observed in 2015
- Several people have expressed their approval of the benched viewing platform, and have been observed reading a book and enjoying the solitude of this beach.
- BMP's installed, as designed, are preventing contaminants other than *E. coli* from directly impacting the beach, however only *E. coli* continues to be the focus of monitoring efforts.

Photos: Included in this report is a subset of the photos taken, see below for a drop box link and additional photos.

Pre-Construction Photos:





Post Construction Photos:







Complete Plans, Photos, and Cost Containment:

Sand Bay Town Beach Project Drop Box link:

<https://www.dropbox.com/sh/aychu8o0wt19qzh/AADG8JqY9g5eXewYmkOa4u-ga?dl=0>

Haines Park Beach – Town of Nasewaupee

Location: Haines Park Beach is located on the Green Bay side of the Door Peninsula in the Town of Nasewaupee and is owned and managed by the Town of Nasewaupee. (HUC code: 04030102, Latitude 44.8551 & Longitude -87.5040)

Background: Haines Park Beach is one of four medium priority beaches that installed Best Management Practices (BMP's) to abate pollutant sources and reduce beach closures. The physical characteristics of Haines Park Beach include impervious runoff from a small parking area, and an intermittent stream discharging surface water runoff and storm water runoff on the south end of the beach area. This site had a very low gradient, was frequently very damp and often contained shallow puddles due to wave action, all of which was conducive to increased *E. coli* levels at the beach. However, this site has a history of having only a few closures and advisories. The most significant contaminants that could be addressed was the storm water runoff from the road and parking area along with avian, or more specifically Canadian Geese. Aside from storm water and avian related pollutants other potential sources of *E. coli* in the immediate vicinity included cladophera, a portable toilet, and neighboring properties with private on site waste treatment systems. The project at Haines Park Beach focused on the sources and issues that could be immediately addressed on site which included the storm water runoff from the road and parking area, avian waste abatement, and the damp and or shallow ponded areas within the beach.

Implementation: The construction of BMP's were completed in October 2014. The signage was installed in the early summer of 2015. BMP's installed included: beach nourishment of a coarse grained sand and native beach grass for a higher and drier beach and to improve nutrient uptake and filtering, and cord walk paths to improved accessibility.

Cost Summaries:

Estimated Cost: \$150,000

Actual Cost: \$85,360.04

GLRI actual cost: \$85,360.04

Water testing summaries: From 2003 to 2014 (12 years) and prior to construction, Haines Park Beach experienced 9 advisories and 6 closures due to elevated levels of *E. coli* bacterial levels. In all of 2015 there were 0 advisories and 1 closure out of 28 water samples. **Note: At this beach all advisories are solely based on *E. coli* levels present. Closures were not associated with other unmeasured pollutants such as heavy metals or nutrients from storm water runoff.** The Door County SWCD in partnership with the Door County Public Health Department and UW Oshkosh will continue to

promote monitoring of Haines Park beach to monitor the success of implemented BMP's for all potential contaminants.

The following link will provide more detailed information on test levels and the number of results during each season:

<http://www.wibeaches.us/apex/f?p=181:11:0::NO:RP>

Highlights, obstacles, and lessons learned:

- This project incorporated a main access path along the eastern side of the beach with smaller paths through the dune grass plantings, which in turns lends to more privacy. Previously all beach goers accessed one small area on the south end which in turn was avoided due to pedestrian traffic.
- This beach was raised to avoid the damp conditions that promote *E. coli* growth and attract children and waterfowl.
- Several people have expressed positive comments regarding the improvements at Haines Park Beach.
- BMP's installed, as designed, are preventing contaminants other than *E. coli* from directly impacting the beach, however only *E. coli* continues to be the focus of monitoring efforts.

Photos: Included in this report is a subset of the photos taken, see below for a drop box link and additional photos.

Pre-Construction Photos:





Post Construction Photos:







Complete Plans, Photos, and Cost Containment:

Haines Park Beach Project Drop Box link:

<https://www.dropbox.com/sh/6jk9lotf3mz8ngc/AADjTYXI9wL3hXA9IIZFkZONa?dl=0>

Portage Park Beach – Town of Sturgeon Bay

Location: Portage Park Beach is located on the Lake Michigan side of the Door Peninsula, about one half mile north of the ship canal, in the Town of Sturgeon Bay and is owned and managed by the Town of Town of Sturgeon Bay. (HUC code: 04030102, Latitude 44.8015 & Longitude -87.3076)

Background: Portage Park Beach is one of four medium priority beaches that installed Best Management Practices (BMP's) to abate pollutant sources and reduce beach closures. The beach is in a somewhat remote part of Door County and has very limited parking in the form of a gravel loop and access lane. The gravel lot was shaped to discharge storm water directly onto the beach. This site has a history of having a couple of closures and advisories in most years prior

to construction of BMP's. The most significant contaminants that could be addressed was from the storm water runoff from the road and parking area along with avian, or more specifically Canadian Geese. Aside from storm water and avian related pollutants other potential sources of *E. coli* in the immediate vicinity included cladophera, and neighboring properties with private on site waste treatment systems. The project at Portage Park Beach focused on the sources and issues that could be immediately addressed on site, which included the storm water runoff from the road and parking area and avian waste abatement.

Implementation: The construction of BMP's were completed in October 2013. The signage was installed in the early summer of 2015. BMP's installed included: A Bio Filter for the parking lot area, coarse grained beach sand and native beach grass plantings for a higher and drier beach and again to improve nutrient uptake and filtering.

Cost Summaries:

Estimated Cost: \$6,318.25

Actual Cost: \$7,781.00

GLRI actual cost: \$7,781.00

Water testing summaries: From 2003 to 2013 (11 years) and prior to construction, Portage Park Beach experienced 16 advisories and 7 closures due to elevated levels of *E. coli* bacterial levels. In all of 2014 and 2015 there were 0 advisories and 0 closures out of 54 water samples. **Note: At this beach all advisories are solely based on *E. coli* levels present.**

Closures were not associated with other unmeasured pollutants such as heavy metals or nutrients from storm water runoff. The Door County SWCD in partnership with the Door County Public Health Department and UW Oshkosh will continue to promote monitoring of Portage Park beach to monitor the success of implemented BMP's for all potential contaminants. The following link will provide more detailed information on test levels and the number of results during each season: <http://www.wibeaches.us/apex/f?p=181:11:0::NO:RP>

Highlights, obstacles, and lessons learned:

- This project included very low cost BMP's to reduce contaminants from being directly routed on to the beach and nearshore waters. Recent water tests over the last two years indicated that the BMP's have reduced advisories and closures.
- BMP's installed, as designed, are preventing contaminants other than *E. coli* from directly impacting the beach, however only *E. coli* continues to be the focus of monitoring efforts.
- Portage Park beach is a hidden gem that many people are unaware of due to the remoteness of the beach.

Photos: Included in this report is a subset of the photos taken, see below for a drop box link and additional photos.

Pre-Construction Photos:





Post Construction Photos:





Complete Plans, Photos, and Cost Containment:

Portage Park Beach Project Drop Box link:

https://www.dropbox.com/sh/zvqgxxf69t0jxlt/AAA_iUrPnT4AoXGCu-S0fIXLa?dl=0

V. *Environmental Results*

This grant began August 1, 2011 though the environmental planning began prior to the first testing results in 2003. Going into this grant agreement it was apparent that the greatest environmental benefits would be achieved by continuing to treat storm water runoff impacts at all six of the beaches participating in implementing BMP's. Secondary sources of beach contamination were also addressed when feasible. It is also again important to note that all testing, advisories and closures have been based on only *E. coli* levels within the water. Throughout this grant period and all previous work on beach program activities, the Door County SWCD has pointed out, that testing for only *E. coli* is short sighted and that there are many other pollutants that can impact beach health. The SWCD is confident that there are significant reductions in heavy metals, petroleum, products and other contaminants carried in storm water that has been abated by the installation of BMP's at the aforementioned beaches.

Earlier in this report is a summary of the advisories and closures for each beach prior to the implementation and post implementation. When summarizing the amount of closures post construction of BMP's there were only three closures combined for all 6 beaches. Three of beaches, (Portage Park Beach, Sand Bay Park Beach and Europe

Bay/Hotz Memorial Park Beach) have yet to experience a closure post construction of BMP's. The remaining beaches, (Lakeside Park Beach, Murphy Park Beach and Haines Park Beach) each experienced only one closure since the construction of BMP's.

Beach testing and observations of beach health will continue at these and other beaches through-out Door County to maintain and improve beach health for all who visit and utilize Door County beaches.

VI. Accomplishments

As previously mentioned the SWCD worked with five municipalities over a span of four years to install BMP's at six Door County beaches. These beach projects will reduce the presence of bacteria, viruses, pathogens, nuisance algae, and other contaminants to levels that humans can still safely enjoy the beach. Although bacteria are used to determine a beach closure or advisory, most times the other contaminants are overlooked. All of these completed projects have reduced the overall storm water impacts to the beach, resulting in overall healthier beaches.

Measures of success, at this point, are the successful installation of practices and the water testing data that has been recorded post construction. As mentioned above, there were only a combined three closures post construction for all six projects. To put this in perspective there were 261 samples taken post construction at these six beaches and only three samples or approximately 1% resulted in a closure. As these sites establish over time it is presumed that the BMP's will continue to fully function for several years to filter, absorb, and prevent contaminants from being delivered to the beach. The SWCD will continue to perform site visits no less than quarterly for each project site and will continue the collaboration with our beach monitoring partners, (Door County Public Health Dept. and University of WI-Oshkosh) to obtain and track beach monitoring results for the swimming seasons and compare pre- and post- restoration results.

VII. Lessons Learned

The actual time periods to construct BMP's for each Beach is essentially limited early spring if the road weight limits have been lifted or after the summer tourism season. None of the municipalities will give up a beach season for installation, thus early fall is the ideal time to start construction. If you start too late in the fall, projects will likely be delayed for an entire year. The SWCD needed to apply for a one year grant extension prior to the construction season in 2014 to ensure completion of the projects and to establish additional monitoring data.

If a municipality is even slightly interested in a future beach restoration or improvement project, it is vital that the planning process starts as early as possible. From the initial survey for establishing a bulkhead line ordinance, through the design and agreement steps, the multiple months for permitting larger project sites, and of course the narrow construction windows for implementation all add up to multi-year projects. Because of the multiple years of funding through the GLRI program and the flexibility to extend the project implementation window the SWCD was able to successfully complete six beach improvement projects with five municipalities.

During the grant period Lake Michigan experienced falling lake levels to record lows in late 2012 and early 2013, followed by rapid recovery in late 2013 and 2014 with an approximate 3 foot gain peaking in July of 2015. This dramatic swing complicated designs, implementation, and retention of sand nourishment. Observations at each beach after storm events were unpredictable. At times sand was washed away via wave action only to return after another storm event. The dynamic changes in beach sand are expected to continually change, though on a positive note the BMP's installed have remained and are functioning as planned.

The complete establishment of the native beach grass is a critical component at each project site. Thus it is important to protect the grass from planting through approximately two growing seasons. On most sites protection with a wooden snow fence is highly recommended along with educational signage to explain the purpose of the grass, sand nourishment, and temporary sensitivity to human traffic. Previous attempts to fence with various plastic mesh fencing required numerous repairs as the constant winds continually caused fence failures. In addition the fencing is not very attractive and municipalities often requested a shorter protection period. One solution to reduce the protection time was to plant the grass plugs at twice the recommended density at Murphy Park beach. As we enter the second growing season the SWCD will evaluate the density of grass for potentially removing the fence one year earlier than previous projects. Planting times are also critical and must be completed in early spring or in late fall preferably during dormancy.

Avian sources of *E. coli* bacteria are difficult to eliminate, however visible reductions of goose populations have been noted. Especially with the installation of the sand dunes and dune grass that provides a visual barrier for the geese to see the food source in the form of a manicure lawn above. During flightless periods for geese it would be a common sight to see Canadian geese lounging on the entire beach and lawn area traveling back and forth as they pleased. Now with only narrow curved paths through the dunes, the geese are not comfortable with walking from the beach through the dunes to the lawn areas. Problems still exist geese loitering on the sand portion of the beach during low use times. Other avian problems still exist with surround docks and piers where seagull, ducks and geese are also congregating. Efforts to further resolve avian sources of *E. coli* will be an ongoing focus for the SWCD and our partners.

Beach health is more about all potential contaminants and not just *E. coli*. Physical observations at all of these project sites prior to construction clearly indicated that there are other pollutants impacting beach health. Whether it was the physical presence of trash or the sheen from petroleum products or the hidden presence of bacteria, as proven in prior research, the importance to treat storm water at each beach cannot be emphasized enough. In the future it may be advantageous to sample for other pollutants for public welfare.

The SWCD will continue to work with the municipalities that implemented BMP's through this project and will also continue to work with and assist other program participants and any potential future projects to implement and maintain best beach management practices as these projects are all unique and dynamic.

Key personnel included:

William Schuster, County Conservationist- Supervisor to all personnel involved with project. Provided all approvals necessary and involved in all decision making under this grant agreement.

Beth Hanson, Administrative Assistant- Managed all required financial paperwork pertaining to EPA Assistance Agreement, including all required documentation for reimbursement.

Greg Coulthurst, Conservationist- (Project Manager), managed all reporting requirements and worked with each personnel on various stages/phases of project. Was main contact for municipalities participating in project and organized all necessary meetings pertaining to fulfillment of project and worked on all phases of project.

Amanda Surfus & Brian Forrest- (Former Project Managers).

Dale Konkol, Rich Propsom (Conservationists) - Main design and survey contacts for the projects. Lead staff on construction oversight.

VIII. Conclusion

The time commitment to work with each municipality to see a project through from start to finish is vital for project success. Furthermore, the process of bidding, project implementation and supervision, was challenging at times, especially as plans need to scaled back to adjust to the changing water levels. Three feet of vertical water levels equated to nearly 100 feet horizontally at some locations, which in turn downsized some of the projects during construction.

The project did not utilized all GLRI funding for construction implementation, as planned, but six really good projects were completed with the five municipalities that wanted to continue with improving there beaches. Unfortunately some municipalities did not want to participate due to ongoing highway improvement projects, site limitations, and or other local issues.

All educational material distributed and placed on site as part of this GLRI assistance project acknowledged all funding partners and included their respective logos. Permanent signs have been posted at the project locations as shown in the post construction photos earlier in this report.