

# Western Basin: Reach 03

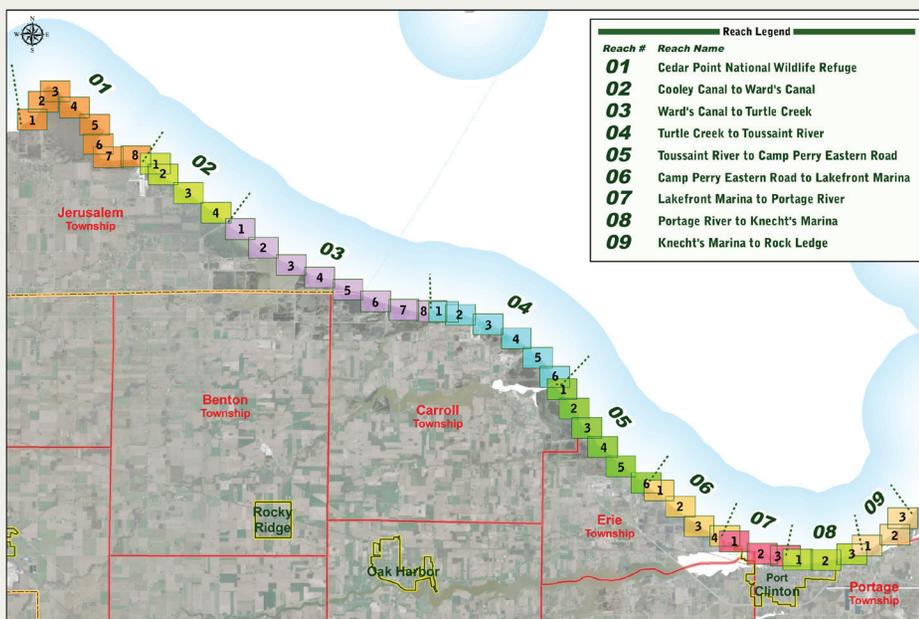


## About the Program

In an on-going effort to assist property owners along Ohio's Lake Erie coast by providing free technical assistance, the *Lake Erie Shore Erosion Management Plan (LESEMP)* is being developed by the Ohio Department of Natural Resources through a partnership between the Office of Coastal Management, Division of Wildlife and Division of Geological Survey.

The *LESEMP* identifies the causes of erosion in specific areas called reaches which are stretches of shore with similar site conditions. The *LESEMP* then outlines the most likely means of successful erosion control based on reach-specific erosion issues, geology and habitat. The objective of the reach-based approach to erosion control is to simplify the decision process while enhancing the effectiveness of solutions to erosion related issues.

The *LESEMP* does not contain any regulatory oversight provisions.



The *LESEMP* is being developed by the project partners, Ohio Department of Natural Resources Office of Coastal Management, Division of Geological Survey and Division of Wildlife. Federal grant funding for this project is provided by the National Oceanic and Atmospheric Administration.

## Description

Reach 03 in the Western Basin Region extends from Ward's Canal at Metzger Marsh State Wildlife Area to Turtle Creek. This reach contains approximately 33,400 feet of shore and consists of nearly all state and federal protected lands. Reach 03 includes the Metzger Marsh State Wildlife Area, the Ottawa National Wildlife Refuge and the Magee Marsh State Wildlife Area. The eastern 1,500 feet of shore in this reach is privately held property and includes a gas dock, marina, campground and beach. This reach crosses the Lucas-Ottawa county line and includes portions of both counties.

The shore in this reach is oriented in a northwest to southeast direction and is fairly uniform from the beginning of the reach to near the county line before gradually bending to face north near Turtle Creek. At the west end of the reach a steel sheet pile jetty extends about 500 feet to the northeast at Ward's Canal. The jetty is a public access site for fishing. Immediately east of the jetty begins an earthen dike armored with rip-rap on the lakeward facing slope. The dike extends about 800 feet to the southeast before bending about 2,250 feet to the end of the Metzger Marsh State Wildlife Area. A small beach has formed at the bend in the dike.

The same dike continues southeast for another 4,000 feet of Ottawa National Wildlife Refuge to a pumping station used to control water levels in the marsh. The pumping station is protected by an approximately 70-foot long rip-rap jetty at the east end. East of the pumping station, the dike continues nearly linearly for another 1,600 feet. The next 4,000 feet of dike follows the shape of the natural shore and includes slight embayments trapping 1,000-foot and 500-foot long pocket beaches before continuing to the mouth of Crane Creek.

At the east end of Crane Creek a 225-foot long steel sheet pile jetty extends perpendicular to the shore. The next 3,500 feet of shore is sand beach supported by five additional shore-perpendicular steel sheet pile groins. The beach crosses from the Ottawa National Wildlife Refuge to Magee Marsh State Wildlife Area. The east portion of the beach is backed by the parking lot of the former Crane Creek State Park. This area of shore is now part of Magee Marsh State Wildlife Area. East of the beach is an approximately 1,250-foot long dike lakeward of additional facilities of the former state park.

East of the former state park access road, the dike steps 400 feet to the south and extends east about 8,500 feet to the Lucas-Ottawa county line. The 400-foot set back of the dike resulted in the accumulation of sand forming a 2,500-foot long of beach lakeward of the dike. The same dike extends an additional 5,500 feet to the east from the Ottawa County line to the end of the Magee Marsh State Wildlife Area. On the property to the east the shore consists of 1,400 feet of sand beach supported by several concrete block and rip-rap groins. A portion of the beach is backed by a steel sheet pile bulkhead supporting a campground and marina facilities on the upland property. At the east end of the reach a rip-rap jetty extends approximately 350 feet from the outlet of Turtle Creek.

There is limited sediment available in the littoral system in this reach, as exhibited by the narrow beaches accumulated at the groins and at small embayments in the dike. Littoral currents in this area are weak and predominantly flow from east to west.

As a large portion of this reach is armored with the rip-rap dike, erosion within this region will generally be limited to the beaches in embayments in the dike and at the former Crane Creek State Park.

## Recession/Erosion

The ODNR Division of Geological Survey has evaluated the recession of Ohio's Lake Erie shore over three time periods: 1877 to 1973, 1973 to 1990 and 1990 to 2004. Changes in the rates measured during each of the time periods are generally attributed to development along the coast and natural factors such as lake level changes.

During the time period from 1877 to 1973 the shore in this area experienced significant changes. Nearly the entire reach was once fronted by a barrier beach separating the marshes from Lake Erie. The shore was highly irregular with large embayments in the barrier beach system. During this time period, the coast was most stable near artificial structures like the jetties at Ward's Canal, Crane Creek and Turtle Creek. For example, the east jetty at Ward's Canal was originally constructed in the late 1800s and accumulated enough sand to greatly reduce erosion rates for about 1,500 feet to the east. By 1957, much of the barrier beaches in the west end of the reach had eroded with the exception of a sand spit accumulated up-drift of the Ward's Canal jetty. Farther east there were small areas of accretion particularly in deep embayments and to the west of the channel jetties at



The fishing pier at Metzger Marsh State Wildlife Area in Lucas County marks the western end of Reach WB 06. The top photos were taken on April 15, 2011, during a storm event and show waves pushing debris up Ward's Canal and spraying over the dike. The bottom photos were taken on a calm day on July 1, 2008.

Crane Creek. This erosion and accretion contributed to the fairly uniform shore present today. Between 1957 and 1968, the steel sheet pile groins at the former Crane Creek State Park were constructed. The groins helped to stabilize the beach in this area but increased erosion of the barrier beaches to the west. By 1973 the sand spit trapped by the Ward's Canal jetty had eroded significantly and the wetlands at Metzger Marsh were nearly completely exposed to the lake. The barrier beaches farther east were very narrow and were breached in several areas. By 1973 some of the barrier beaches particularly in the areas west of Crane Creek were beginning to be stabilized with rip-rap.

From 1973 to 1990 recession slowed considerably from Ward's Canal to Crane Creek due to the construction of rip-rap dikes along the shore to enclose Metzger Marsh. The dikes were constructed in the location of the former barrier beach, reclaiming a large area of shore. East of Crane Creek, earthen dikes within Magee Marsh were also armored. For most of the reach the dikes were fronted by a beach with significant erosion rates. Average recession rates ranged from 0.0 feet per year where the rip-rap dike was built over the barrier beach just west of Crane Creek to 17.4 feet per year in areas

where the beaches in front of the dikes were rapidly eroding.

By 2004 the beaches fronting the dikes had nearly completely eroded throughout the reach. The only exceptions are where artificial structures or embayments in the dike trap sediments. Wide beaches still exist at the former Crane Creek State Park beach and up-drift of an offset in the dike just east of the former state park. A pumping station was also constructed in the coastal dike to control water levels in Metzger Marsh. From 1990 to 2004 average recession rates ranged from 0.0 feet per year where the shore was protected with the rip-rap dikes to 2.55 feet per year at the former Crane Creek State Park beach. The rip-rap dikes make up the shore for most of the reach so recession during this time period was extremely localized.

### Flooding

The low-lying banks of this and the surrounding reaches are susceptible to flooding as well as erosion. Floods have usually been associated with gales from the northeast, such as may occur when tropical storms or the remnants of hurricanes migrate to the northeastern U.S. and southeastern Canada. The resulting winds, rotating counterclockwise around the storm



*A dike extends from Metzger Marsh State Wildlife Area southeast for 4,000 feet in front of the Ottawa National Wildlife Refuge to a pumping station used to control water levels in the marsh. The pumping station is protected by an approximately 70-foot long rip-rap jetty at the east end.*

center, may blow over many miles of open lake, piling water in the Western Basin and leading to overtopping or breaching of dikes, flooding the upland behind them. If the storm coincides with a period of high water, the effect is intensified. Due to this area's history as a wetland known as the Great Black Swamp, the widespread lacustrine clay soils are not conducive to drainage. Floodwaters may remain several feet deep for days after a storm.

Another storm-related hazard in this reach is ice. The low-lying shore presents little barrier to ice rafted on lake waves and piled by northeast winds against the dikes. Any structures built within a few feet of the crest of the dike are susceptible to damage.

### Beaches/Sand Supply

The general erosion of beaches in this region demonstrates the lack of available sediment. This is due in part to trapping of sediment by artificial structures constructed to the southeast, particularly at Locust Point (to the east of this reach). The addition of structures within this reach has also had a notable effect on the sand supply in this area. For example, the construction of the steel sheet pile groins stabilized the beach at the former Crane Creek State Park but increased erosion of the barrier beach at Metzger Marsh. The overall hardening of the shore with rip-rap dikes also reduced sediment supplies in the area and caused nearshore depths to increase due to downcutting. An overall reduction of sediment in the littoral system due to widespread armoring of Lake Erie's coast has also contributed. Narrow beaches still exist where trapped by embayments in the dike or other artificial structures.



### Use of Shore Structures

The predominant shore structure is the rip-rap dikes fronting most of the reach. The dikes were constructed after the erosion of barrier beaches to protect the wetlands at Metzger Marsh State Wildlife Area, Ottawa National Wildlife Refuge and Magee Marsh State Wildlife Area. The only other shore structures in this reach are the jetties at Ward's Canal, Crane Creek and Turtle Creek as well as the steel sheet pile groins at the former Crane Creek State Park beach. These shore perpendicular structures have helped stabilize the up-drift shore by trapping sand but have functioned at the expense of down-drift barrier beaches.

### Summary

The shore of the Ward's Canal to Turtle Creek reach is nearly completely protected lands and includes Metzger Marsh State Wildlife Area, Ottawa National Wildlife Refuge and Magee Marsh State Wildlife Area. Much of the shore in this reach is protected by rip-rap dikes. Beaches exist where sand is trapped by artificial structures or in embayments in the dike. The widest beach is at the former Crane Creek State Park. Historically this area has experienced significant erosion resulting in the loss of the barrier beach system that once fronted the marshes in the area. Since the construction of the rip-rap dike in the 1980s the beaches fronting the dikes have nearly completely eroded. The shore is now stable with erosion and accretion limited to narrow beaches trapped by artificial structures or in embayments in the dike.



*A 225-foot long steel sheet pile jetty extends into Lake Erie along the west bank of Crane Creek (right photo). To the east, the next 3,500 feet of shore is sand beach supported by five additional shore-perpendicular steel sheet pile groins (left photo). Both pictures were taken from a boat on October 6, 2010.*



GIS Data Sources:  
 Aerial Photography - OSIP, State of Ohio, 2006  
 Political Boundaries and Transportation - ODOT, 2007  
 Public Access - ODNR OCM, 2009-10

0 250 500 1,000 Feet

Created By:  
 Ohio Department of Natural Resources  
 Office of Coastal Management  
 105 West Shoreline Dr, Sandusky, OH 44870



Legend					
	Reach Boundary		U.S. Route		Township Road
	County Boundary		State Route		Municipal Street
	Municipal Boundary		County Road		Park Road
	Township Boundary		Public Access		Other Protected

Ottawa  
National Wildlife Refuge

GIS Data Sources:  
Aerial Photography - OSIP, State of Ohio, 2006  
Political Boundaries and Transportation - ODOT, 2007  
Public Access - ODNR OCM, 2009-10

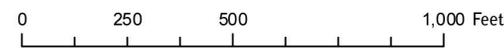


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Legend		
Reach Boundary	U.S. Route	Township Road
County Boundary	State Route	Municipal Street
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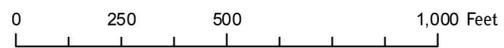
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Legend		
Reach Boundary	U.S. Route	Township Road
County Boundary	State Route	Municipal Street
Municipal Boundary	County Road	Park Road
Township Boundary	Public Access	Other Protected

Magee Marsh  
State Wildlife Area

GIS Data Sources:  
Aerial Photography - OSIP, State of Ohio, 2006  
Political Boundaries and Transportation - ODOT, 2007  
Public Access - ODNR OCM, 2009-10



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## Recommendations

The recommendations included below are options that may be applicable within this reach and should only be used for planning purposes. Based on the above physical characteristics, the following recommendations are suggested for the Ward's Canal to Turtle Creek reach. Each recommendation includes a brief overview of the solution prior to addressing areas within the reach where the recommendation is best suited. For more information on any of the items listed below, please refer to the LESEMP Glossary and Appendix: Erosion Control Solutions.

In addition to the recommendations listed below a "do nothing" alternative should also be considered. This may be a viable, and even favorable, alternative for much of Ohio's Lake Erie shore. In areas with low erosion rates where the shore is already heavily armored, additional protection might not be necessary. In these areas, attention should be focused on monitoring and maintaining the structures. In other areas, particularly those with a natural shore and low erosion rates, the best option may be to

hold development back from the coast and allow natural erosion/accretion processes to occur.

This is applicable for most of this reach as the shore has been effectively stabilized by the dikes fronting the Metzger Marsh State Wildlife Area, Ottawa National Wildlife Refuge and Magee Marsh State Wildlife Area.

### Sand Management:

**1. Conserve Sand Resources:** *Conserve sand resources within the shore and nearshore areas. Sand is a limited resource in constant fluctuation. Avoid removing sand from the system; sand moved or excavated during construction along the shore should be placed in the nearshore, not on the upland and should not be incorporated into the construction project.*

This recommendation is applicable to the entire reach. As sand resources are limited in this area, conserving the available sediment is critical. Historically, the stability of the shore was dependent on the sediment available to sustain beaches. Since the barrier beach system eroded, the



*The low-lying banks of this and the surrounding reaches are susceptible to flooding which is usually associated with gales from the northeast. Resulting winds, rotating counterclockwise around the storm center, pile water in the Western Basin and lead to overtopping or breaching of dikes and flooding. The top photos show the beach at the former Crane Creek State Park during such a storm on April 15, 2011. The bottom photos show nearly the same views on a calm day on May 7, 2011.*

shore is predominantly protected by dike structures. Future efforts should be focused on conserving sand resources to protect the beach habitat in the recesses formed by the dike and at the former Crane Creek State Park beach.

**2. Beach Nourishment:** *Supplement the current sand supply with beach nourishment, also known as beach fill or pre-fill. Beaches protected by groins and detached breakwaters will benefit from initial nourishment (pre-fill during or directly after construction) and periodic renourishment. The sand used in these projects should be acquired from an upland source.*

Since most of the shore is fronted by rip-rap dikes, future beach erosion will likely be localized to the small pocket beaches trapped by embayments in the dike and the wide beach trapped by the groins at the former Crane Creek State Park. Beach nourishment is an option for habitat protection.

**3. Dredging:** *Dredge marinas and harbors on as frequent a basis as possible to add sand into the littoral system. Dredging of navigation channels at harbors and marinas enhances navigation for boaters and provides sand for downdrift areas when placed along the shore. When dredged material is disposed of on the upland or in offshore areas, the material is no longer a benefit to the littoral system. In-lake placement is preferred as long as the sand meets the grain size and total organic carbon criteria. Uncontaminated dredge material that is composed of sand and gravel should be placed in the nearshore through sidecasting or placing downdrift. Placing sand in shallow water keeps the sand in the nearshore environment and the littoral system. Sand placed into deeper waters will likely be lost to the system and will not nourish downdrift beaches.*

If the navigation channel at Turtle Creek needs maintenance dredging, nearshore placement of the dredge materials should be considered. Should the dredged materials be suitable for the nearshore environment,

nearshore placement would be highly beneficial to nourish the beaches fronting the dikes at the Magee Marsh State Wildlife Area.

**4. Vegetation:** *Encourage growth of native vegetation on the back beach. Beach vegetation encourages the formation of a dune system by holding sand in place and providing protection from wind. It is also possible to simply allow the natural succession of native plant species to grow along the beach.*

This recommendation applies to the beaches trapped by the shore perpendicular structures and at embayments caused by bends in the dike. The vegetated back beaches and small dunes at the former Crane Creek State Park demonstrate the effectiveness of this recommendation. Planting native



*What is known as the birder's beach at the east end of Magee Marsh State Wildlife Area is shown during an April 15, 2011 storm event (top photos) and during calm day on September 23, 2010 (bottom photos).*

vegetation on the beaches fronting the dikes in this reach will also help prevent sand from blowing over the dikes, providing additional protection for the marsh habitats.

### **Toe Protection:**

**5. Detached Breakwaters:** *Detached breakwaters may be useful in areas where beaches are present or likely to form. As opposed to groins which trap sand moving along the shore, properly designed and constructed detached breakwaters will aid in retaining a beach by limiting the movement of sand offshore (perpendicular to shore) while still allowing for the alongshore movement of sand. An initial beach nourishment (pre-fill) and periodic renourishment will often be advantageous to creating and retaining the beach behind the breakwater while limiting impacts to neighboring shorelines. Some regulatory agencies may require pre-fill, monitoring and periodic nourishment or bypassing as one of the design components for a project that includes detached breakwaters.*

Detached breakwaters would function well in the shallow water throughout the reach and could be used to restore the barrier beach that once fronted the area.

**6. Revetments:** *Revetments along the toe of a bank will aid in protecting against wave-based erosion. In areas without beaches, a structural measure may be necessary to protect the toe of the bank. The low-relief banks within this reach have relatively gradual slopes, which are ideal for revetment development. In essence the revetments form a stable bank slope, providing protection to the soil underneath while breaking up wave attacks. Since*



*East of Magee Marsh, about 1,500 feet of shore is private property and includes a gas dock, marina, campground and beach near the mouth of Turtle Creek.*

*material eroded from the bank is one source of beach-building sand, one of the design components for a revetment may be the inclusion of sand pre-filling in the amount equal to that which would have been added to the system over the life of the structure.*

The lakeward face of the existing dikes in the area are armored with rip-rap and form a low revetment along most of the reach. This structure has been effective in limiting coastal recession and protecting the wetlands of Metzger Marsh State Wildlife Area, Ottawa National Wildlife Refuge and Magee Marsh State Wildlife Area.

### **Bank Modifications:**

**7. Surface Water Management and Flood Protection:** *Low lying areas should be protected from excess surface water and flooding from the lake and from upland runoff. In areas prone to flooding erosion protection should include surface water management design elements such as collection areas, retaining structures, and drainage ditches or culverts. Surface water should be routed away from the face of the bank. In areas where gullies or rills are forming, surface water is slowly eroding the face of the bank. Where possible, re-route water away from the bank toward a planned collection area and drainage system.*

The rip-rap dikes in this area were installed to manage surface water from the lake. Additionally, a pumping station was added to the dikes at the Ottawa National Wildlife Refuge to monitor and control water levels in Metzger Marsh. Excess water in the ponds at Ottawa National Wildlife Refuge is generally flushed by Crane Creek. The dike structures at Magee Marsh include a man-made drainage ditch lakeward of the ponds at the marsh, yet behind the rip-rap dike. Excess water in Magee Marsh is generally routed to Turtle Creek.

**8. Vegetation:** *Encourage growth of vegetation along the bank slope. Where possible plant vegetation, preferably native species, along the bank to remove excess ground water while retaining soil strength. It is also possible to simply allow the natural succession of native plant species to grow along the bank.*

This reach primarily consists of state wildlife areas and a national wildlife refuge, making vegetation a particular importance. Native vegetation on the pocket beaches and earthen portion of the dikes would reduce excess water and protect the dikes and beaches from wind.

## Management and Monitoring:

**9. Bank-Top Management:** *Keep heavy materials, equipment or structures well back from the edge of the bank-top. Any structure (concrete decks, stone walls) or heavy object (vehicles or construction equipment) placed near the bank edge will increase the stress within the soil and can lead to slope failure.*

This reach primarily consists of low marsh land separated from Lake Erie with a system of earth and rip-rap dikes. While there are no high bluffs or banks in the area, the bank-top management recommendations do apply to the top of the dikes. It is unlikely that heavy structures or fill would be placed near the shore of the state wildlife areas or the national wildlife refuge, but several of the dikes have roads for maintenance access. Care should be taken when accessing the area with vehicles or other equipment to prevent damage to the dikes.

**10. Coordination of Projects:** *Continuation of similar erosion control measures along a stretch of shore will often yield more effective protection than the installation of multiple types of structures adjacent to one another. Most erosion control measures function better when utilized over large areas of the shore.*

The shore of this reach demonstrates the benefits of continuity of shore structures. Historically stabilizing one area of this reach with shore perpendicular structures likely contributed to the erosion of down-drift barrier beaches. Currently, much of the shore is protected with rip-rap dikes. The effectiveness of these structures in preventing coastal recession and protecting the wetlands demonstrates the advantages of coordinating projects. Coordination of future projects will also have the significant advantage of limiting the amount of time the littoral system is disturbed in the protected wildlife habitats.



*The wetlands at Magee Marsh*

**11. Shore Structure Management/Monitoring:** *Monitor and maintain shore structures. Routine monitoring of shore structures will allow for early detection of any potential failures. Smaller repairs performed more frequently will be less costly and can often increase how long the structure will be effective at controlling erosion. Should removal of an aged or deteriorating structure be necessary, consider the above recommended items as potential future solutions.*

Construction of the rip-rap dikes fronting this reach was completed to support or replace the function of existing barrier beaches. Most of the dike structures were constructed in the 1980s and the shore perpendicular structures (jetties and groins) are even older. The condition of the structures should be closely monitored and repairs should be made when necessary. Routine monitoring of the dikes should include inspecting for surface water flows, displaced or fractured armor stones, or signs of water seepage through the dike.

If new erosion control measures are installed the recommendations listed above should be considered. When structural repairs are needed construction should be managed to limit the effects on coastal habitat in the area. For example, appropriately timing the repairs and maintaining several areas at once could limit the amount of time of the area is disturbed.

## References:

- Benson, D. Joe. Report of Investigations No. 107, Lake Erie Shore Erosion and Flooding, Lucas County, Ohio State of Ohio, Department of Natural Resources, Division of Geological Survey, Columbus, 1978.
- Ohio Department of Natural Resources, 1998 Final Coastal Erosion Area (CEA) Mapping.
- Ohio Department of Natural Resources, 2010 Final Coastal Erosion Area (CEA) Mapping.

## Learn More:

LESEMP Webpages: [ohiodnr.com/tabid/20501.default.aspx](http://ohiodnr.com/tabid/20501.default.aspx)

ODNR Office of Coastal Management

105 West Shoreline Drive, Sandusky OH 44870

419.626.7980 | [coastal@dnr.state.oh.us](mailto:coastal@dnr.state.oh.us) | [ohiodnr.com/coastal](http://ohiodnr.com/coastal)

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