

Western Basin: Reach 07



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.

Description

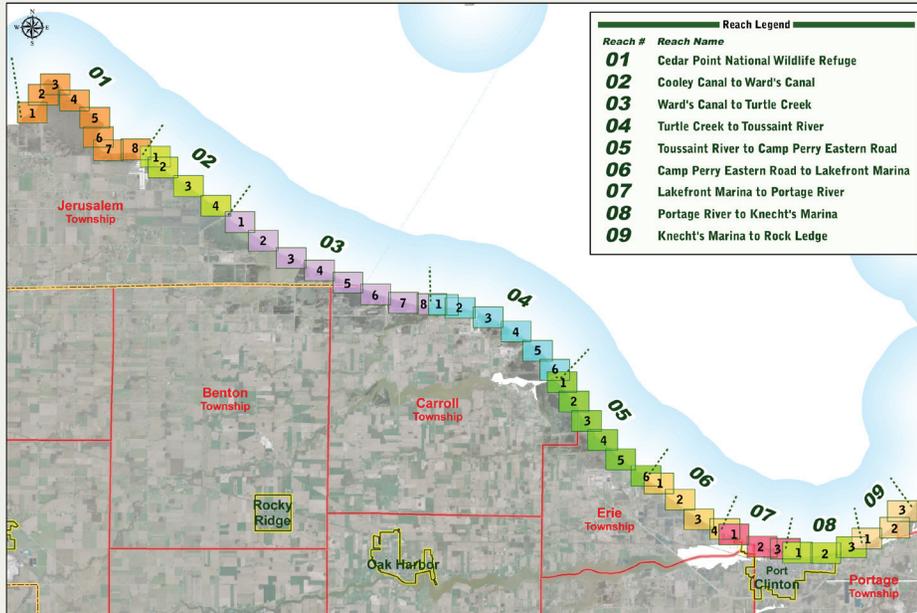
Reach 7 of the Western Basin Region extends from Lakefront Marina at the west end of Port Clinton to the Portage River. This reach contains approximately 10,300 feet of shore and is nearly completely comprised of residential and commercial development.

The coast in this reach is oriented in a northwest to southeast direction and is fairly uniform. Any deviations from the uniform shore can generally be attributed to manmade structures. At the west end of the reach is the east jetty at Lakefront Marina. Immediately east of the jetty there is 150 foot rip-rap revetment and a narrow beach fronting the east basin at Lakefront Marina. The next 600 feet of shore is unarmored beach leading to a small groin extending about 100 feet into the lake. The inlet to Schooner Point Marina is located approximately 100 feet east. The inlet is stabilized with a 280-foot long jetty bending to the northeast. On the east side of the inlet, a second 150-foot jetty extends lakeward.

The next 1,500 feet of shore is residential property protected with a variety of seawalls and revetments. This area also has a few small groins and one larger 100-foot long groin about 300 feet east of the Schooner Point Marina. There is a narrow beach between the groin and marina jetty and a second narrow beach about 600 feet east in a small embayment created by a bend in a seawall. Otherwise, sand accumulation in this area is minimal.

East of the residential area there is a 300-foot long beach leading to a concrete capped rip-rap pier and a revetment fronting the Lakeshore Condominiums. The armor stone revetment continues lakeward of the Moose Lodge. The next 3,550 feet of shore is comprised of an armor stone revetment protecting West Lakeshore Drive (State Route 163). This area is often fronted by a narrow transient beach. The beach begins to widen east of the revetment where sand is trapped by the Waterfront Condominiums which extend about 150 feet into the lake. The condominiums are protected with an armor stone revetment.

There is a 300-foot long beach set back about 300 feet from the east end of the fill at the Waterfront Condominiums. The beach extends lakeward of the Port Clinton Yacht Club. The east end of the yacht club is protected with a



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.

750-foot long revetment. The east 400 feet of this reach is unarmored beach owned by the state of Ohio at the base of the west Portage River jetty.

Nearshore slopes in this reach range from about 1 degree for the first 100 feet to about 0.3 degrees farther offshore and decrease significantly near the Portage River. Littoral currents in the area are weak with a net direction from northwest to southeast. The embayment at Port Clinton is an area of converging littoral currents. This causes a gradual accumulation of available sand in the littoral system. Nearshore sand deposits generally increase from west to east in this area due to the long term trapping of sediment by the Portage River jetties. Lakeward of the sand deposits glacial till and till lag deposits of muddy sand and gravel are exposed.

This reach is extensively developed and nearly completely protected with a variety of shore structures. Future erosion in this area will likely be limited to small unprotected pockets or gaps between structures.

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.

From 1877 to 1973 the shore in this reach experienced slow recession in the western portion (generally less than 2 feet per year) and slow to moderate accretion at the eastern end updrift of the Portage River jetties. The original jetties at the Portage River were constructed prior to 1877 and have gradually trapped sediment causing a significant advance of the shore. Long term accretion has been interrupted by slow recession rates between 1939 and 1957 and between 1968 and 1973 showing that this area is particularly susceptible to high lake levels.

From 1973 to 1990 average recession rates ranged from 0 feet per year to 5.3 feet per year. Recession was generally limited to small areas without shore protection and was greatest just east of the Lakefront Marina jetties. This area is unarmored and experiences reduced sediment supply due to sand trapped updrift of the Lakefront Marina/Portage River jetties. The unprotected beach area just east of the revetment at the Port Clinton Yacht Club also experienced average recession rates of up to 1.4 feet per year. Average recession rates were minimal for the rest of the reach due to extensive armoring of the shore.

From 1990 to 2004 average recession rates ranged from 0 feet per year to 0.1 feet per year. Recession was minimal over the entire reach due to the extensive armoring of the shore. Erosion in this area is generally limited to small gaps between discontinuous structures and wears on the older shore structures.



A narrow beach fronts the 150-foot long rip-rap revetment east of the basin at Lakefront Marina. The marina's entrance channel is shown in the bottom photo, and the narrow beach in the top and right photos.

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 center, may blow over many miles of open lake, piling water in the western basin and leading to overtopping or breaching of shore structures, 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 to homes and structures 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 shore. Structures built along the shore are susceptible to damage.

Beaches/Sand Supply

The long term accretion along the shore due to the Portage River jetties demonstrates the availability of sand in the littoral system. The Port Clinton embayment is generally an area of converging littoral currents causing sand to gradually accumulate in this area. While sand accumulation is greater

to the east of the Portage River this reach does have sand available in the littoral system and nearshore. The availability of sand in this reach has allowed narrow beaches to persist lakeward of shore structures such as the revetment fronting West Lake Shore Drive.

Use of Shore Structures

Nearly the entire reach from Lakefront Marina to the Portage River is protected with shore structures. The only significant gaps in protection are at the ends of the reach just east of the Lakefront Marina jetty and just west of the Portage River jetty. Lakeward of the Lakeshore Condominiums and Waterfront Condominiums seawalls have been constructed landward of adjacent structures to allow recreational beaches to form, but the shore is structurally protected.

The western portion of this reach includes a residential area protected with a variety of seawalls and revetments. Most structures are continuous across several properties and were constructed without gaps or unarmored areas between structures. There are few shore-perpendicular structures, but sand accumulation is minimal. Narrow beaches have accumulated in embayments caused by bends in seawalls and revetments. A large part of this reach is protected with a single 3,550-foot long stone rip-rap revetment lakeward of West Lakeshore Drive. The revetment was completed in 1972 and has effectively stabilized the shore. The eastern portion of the reach is protected with several armor stone revetments and seawalls. In some cases the structures area set back from the shore and fronted by beaches.



The 3,550-foot long revetment north of West Lakeshore Drive (State Route 163) west of downtown Port Clinton is shown in the above photos looking west at the Moose Lodge (left), from the same spot looking east toward the Portage River (right).

Summary

The reach from Lakefront Marina to the Portage River consists of highly developed commercial and residential property and is nearly completely armored with protective structures. The significant structures in this reach are the jetties at Lakefront Marina and the Portage River, and the 3,550-foot stone rip-rap revetment protecting West Lake Shore Drive. Erosion is greatest in the small areas not structurally protected, particularly immediately downdrift of the Lakefront Marina jetties. The area up-drift of the Portage River jetties has historically experienced accretion due both to the structures trapping sand and converging littoral currents in the Port Clinton embayment. Future erosion will likely be limited to the small unprotected areas at the ends of the reach and to discontinuities or small gaps between structures. As a result of the extensive structural protection recession rates in this reach are minimal. With adequate maintenance of the protective structures this reach is expected to remain stable.

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 Reach WB 07: Lakefront Marina to the Portage River. Each recommendation includes a brief overview of the solution prior to addressing areas within the reach where the recommendation is best suited.



The transient beach is north of West Lakeshore Drive and west of the Waterfront Condominiums. The shore is shown from the beach view in the left photo and from the water in the right photo.

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. The Lakefront Marina to Portage River reach generally has a stable shore with low erosion rates. In areas where the shore is protected with effective structures 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 shore and allow natural erosion/accretion processes to occur. This option should be considered in the unarmored beach area just west of the Portage River jetties.

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 applies to the entire reach. Much of this reach has experienced overall sand accretion due to converging littoral currents and the Portage River jetties. Still sand is a limited resource.



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

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 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

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 Aerial Photography - OSIP, State of Ohio, 2006
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Conserving sand resources is especially critical in the unarmored area just east of the Lakefront Marine jetties. The shore in this area consists of a narrow sand beach backed by a low vegetated dune. The transport of sand to this area is currently disrupted by the Lakefront Marina jetties. A further reduction in sand supply would lead to increased erosion in this area.

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.



Standing on the east Portage River jetty and looking north (top) the treeline at the left of the picture hides the river's west jetty. The small beach north of the tree line and west of the west Portage River jetty is shown looking west from the a public transportation ferry heading north up the channel (bottom).

This recommendation is applicable throughout the reach. A large portion of this reach is fronted by narrow beaches that would benefit from nourishment. The addition of beach nourishment would be especially beneficial at sites with existing structures to stabilize it or as part of new construction for detached breakwaters.

3. *Sand Bypassing:* Move sand from areas of excess accretion, usually up-drift of a shore perpendicular structure, to areas downdrift. By redistributing sand within the nearshore system, the littoral drift in the area will be more evenly dispersed.

Sand bypassing would be the most beneficial at Lakefront Marina. The area immediately downdrift of Lakefront Marina is unarmored and has experienced significant erosion while the area up-drift of Lakefront Marina has accumulated sand. It may not be feasible to bypass current accumulation as up-drift areas have been developed but bypassing future accretion would substantially reduce erosion in the area between the jetties at Lakefront and Schooner Point marinas.

4. *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 mouth of the Portage River 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 beneficial to nourish the area west of the marina jetties. Beneficial uses of dredge material should also be considered if the entrances to Lakefront Marina or Schooner Point Marina need maintenance dredging. Both the area between the marinas and the residential area downdrift of Schooner Point Marina would benefit from placement of the dredge materials.

5. **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.

Native vegetation in the beach area to the east of the Lakefront Marina jetties would be beneficial to help encourage dune formation and stabilize the unarmored shore. This recommendation also applies to the beach area between the Port Clinton Yacht Club and the Portage River's west jetty.

Toe Protection:

6. **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 and periodic nourishment 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 would be beneficial for most of the reach. Detached breakwaters could help create and sustain the narrow beaches in the residential area at the west end of the reach. Detached breakwaters would also function well as additional protection lakeward of the revetment along West Lakeshore Drive.

Beach nourishment or sand pre-fill should be included in the design of a detached breakwater to prevent the structure from trapping littoral material and causing increased erosion on adjacent properties.

7. **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 material eroded off the bank is one source of beach-building sand, some

regulatory agencies may require that one of the design components for a revetment 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.

Revetments are used extensively in this reach protecting approximately 6,400 feet of coast. Revetments have been effective at stabilizing the shore. The availability of sand and shallow nearshore depths have allowed narrow beaches to persist lakeward of many of the revetments, particularly lakeward of the revetment protecting West Lakeshore Drive.

Bank Modifications:

8. **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.

This reach is comprised of highly developed, low lying lake plains. The low banks in this reach have been stabilized with seawalls and revetments to protect upland development very close to the shore. Surface water flows, including storm water outflows, can cause extreme localized erosion. Surface water collecting on roadways or parking lots near the shore should be routed away from the bank or beach whenever possible.

9. **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.

Planting native vegetation on the upland above the revetments and seawalls in this reach would reduce excess surface water and help stabilize the low banks. Vegetation should be closely monitored on the actual structures. For example, vegetation allowed to grow on the rip-rap revetment fronting West Lakeshore Drive could damage the structure by causing stones to be broken or displaced.

Management and Monitoring:

10. 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 recommendation applies to the low banks and structure crests throughout this reach. Several commercial and residential structures have been placed immediately landward of the seawalls and revetments in this reach. Further development near the crest of the structures could cause damage. Care should also be taken when maintaining shore structures or accessing the area with vehicles or other equipment to prevent damage.

11. 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.*

This reach demonstrates the benefits of shore structure continuity. The reach is nearly completely armored with a variety of shore protection types and few significant gaps between structures. A large portion is protected with the revetment fronting West Lakeshore Drive. This structure has effectively prevented coastal recession and stabilized the roadway. The revetments fronting the Moose Lodge and Lakeshore Condominiums to



The beach north of the revetment along West Lakeshore Drive in Port Clinton is shown in the above photo. The cooling tower of the Davis Besse Nuclear Power Station which is 9.5 miles west is seen in the background.

the west have been placed immediately adjacent to the roadway revetment. This has effectively created a continuous structure and prevented localized erosion in gaps between structures.

Previous coordination of projects is a significant advantage this reach possesses. Future construction should consider coordination of projects especially as existing structures age and require maintenance or replacement.

12. 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.*

Many of the structures in this reach were constructed more than 30 years ago. The condition of the structures should be closely monitored and repairs should be made when necessary. If new erosion control measures are installed the recommendations listed above should be considered. A combination of recommendations may be the most effective solution. For example, to further protect an aging revetment fronted by a narrow beach, detached breakwaters with sand pre-fill may be considered.

References:

- Benson, D. Joe. Draft Open File Report 96-xxx, Lake Erie Shore Erosion and Flooding, Ottawa 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

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