

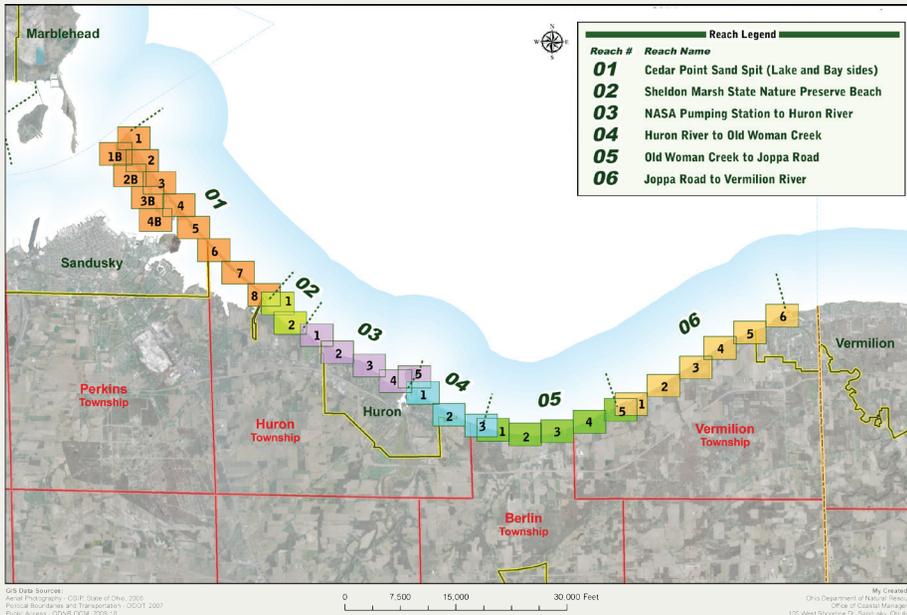
Erie County: Region CV Introduction *LESEMP*

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.

Introduction

The Lake Erie Shore Erosion Management Plan Cedar Point to Vermilion Region includes the Lake Erie coast from the west end of the Cedar Point sand spit to the Vermilion River in Erie County. Lake Erie's shore from Cedar Point to Vermilion forms a broad embayment containing the southernmost point of the Great Lakes.

The shore generally transitions from barrier beaches along the Cedar Point sand spit to low-lying lake plains with bluffs of gradually increasing height. Much of the shore is fronted by sand beaches. Beach widths are greatest updrift of the large shore-perpendicular structures at the tip of Cedar Point and at Huron Harbor but narrow or transient beaches are common throughout the reach. The east end of the reach is fronted by several well-defined sand bars.

The Cedar Point to Vermilion Reach is set between the mouth of the Sandusky Bay and the Vermilion River. The shore of this reach is intersected by the Huron River and several smaller creeks including Sawmill, Turtle, Old Woman, Cranberry, Chappel, Sugar Creek and Darby, and a variety of natural streams that are named ditches.

Because many of the residential properties on the Cedar Point sand spit extend to both the lake and bay shores, the *LESEMP* Cedar Point to Vermilion Region includes descriptions and erosion management recommendations for both the lake and bay shores of Cedar Point. This is intended to simplify the *LESEMP* resources for property owners on Cedar Point.

The *LESEMP* Cedar Point to Vermilion Region includes approximately 22.1 miles of Lake Erie lake shore and about 7.8 miles of shore on Sandusky Bay. This totals nearly 22 percent of Ohio's 312-mile coast. The Cedar Point to Vermilion Region (from west to east) includes the Cedar Point Amusement Park, the residential community along Cedar Point Road, Sheldon Marsh State Nature Preserve, and the lakefront communities in Huron Township, the City of Huron, Berlin Township, Vermilion Township and the west side of the City of Vermilion.

Prior to development, the shore of the Cedar Point to Vermilion Region was characterized by fairly continuous sand beaches fronting bluffs with

steadily increasing heights. A continuous sand spit separated the east end of Sandusky Bay from Lake Erie. This barrier beach extended from the tip of Cedar Point to near the mouth of Sawmill Creek. East of Sawmill Creek the lake plains gradually increased in height to 30-foot bluffs near the east end of the reach. The bluffs were fronted by almost continuous narrow beaches.

As the natural harbors in Sandusky, Huron and Vermilion were developed starting in the late 1800s, large shore-perpendicular structures were built by the federal government to provide safe navigation. These structures immediately began trapping sediment causing wide beaches to accumulate updrift and erosion of downdrift beaches. Further recreational and residential development led to the construction of groins to stabilize eroding beaches. Several areas were eventually protected with a variety of seawalls and revetments to prevent additional recession. The widespread armoring of the Lake Erie shore also reduced the amount of sand available to sustain beaches, contributing to the overall reduction of beaches in the area.

The net direction of littoral currents in the Cedar Point to Vermilion Region is from east to west. Littoral currents are generally stronger near the west end of the region and weaken to the east. Cross currents, localized irregularities and periods of alternating littoral currents are common near the east end of the reach. Littoral currents are also highly variable in the embayment at Sheldon Marsh's barrier beach and often move from the ends of the beach to the center and offshore.



A 2008 photo looking south with the city of Sandusky in the background (left). July 2011 looking southeast along the bay shore of Reach CV 01 (middle). A September 2009 photo looking northwest at the bay shore in Reach CV 01 during a period of low water caused by a storm event.

Description

At the west end of the region, the Cedar Point jetty extends about 5,000 feet (0.95 miles) into the lake at the mouth of the Sandusky Bay. The original jetty was constructed in 1897 to prevent migration of the Cedar Point sand spit and to reduce sand transport into the Sandusky Bay shipping channels. Sand immediately began accumulating updrift of the structure necessitating its extension in 1922. Updrift of the jetty the Lake Erie shore of Cedar Point is fairly uniform and predominantly sand beach but transitions to an armor stone revetment near the southeast tip. The bay shore is much less uniform and contains several small peninsulas formed as sand washed over the barrier beach during past storms. The Cedar Point sand spit is completely developed. Southeast of the Cedar Point Amusement Park resort and marina, most of the sand spit is residential development. The Point Retreat Condominiums and marina make up the southeastern tip of the sand spit.

Southeast of the Cedar Point sand spit is Sheldon Marsh State Nature Preserve. The barrier beach at Sheldon Marsh originally formed the shore connected end of the Cedar Point sand spit, but storms and high lake levels from the 1970s to the 1990s resulted in the landward recession of the barrier beach. The barrier beach today is more than 1,310 feet landward of its 1972 position, and is separated from the surrounding shore at the Point Retreat Condominiums to the northwest and the NASA Pumping Station to the southeast. This separation occurred because the condominiums and

pumping station have hardened shores, whereas the barrier beach at Sheldon Marsh does not. The hardening of the shore at the ends of the beach and an overall reduction of sand supply– due to the jetties at Huron Harbor– have resulted in significant erosion and recession of the barrier beach. The beach has recessed enough to form a significant embayment in the shore, further isolating the area and forming a separate, complex littoral system.

The harbor breakwaters and confined disposal facility at the mouth of the Huron River have had a significant impact on the Lake Erie shore both to the east and west. The jetties at Huron Harbor were originally constructed in 1827 and 1831 and immediately began trapping sand updrift. The large harbor structures have prevented littoral transport of sand to the shore west of the harbor. Due to the lack of sand supply and periods of high water, most beaches to the west of the harbor, including Sheldon Marsh, have eroded. East of the Huron Harbor a wide beach has accumulated. The beach is widest directly updrift of the harbor jetties and tapers to discontinuous, narrow, transient beaches near Old Woman Creek. This area is mostly residential or commercial development with the exception of the industrial facilities at Huron Harbor.

To the east, Old Woman Creek is one of Ohio’s few remaining examples of a natural coastal estuary. The barrier beach and the hydraulic connection between Lake Erie and the Old Woman Creek are highly dynamic and particularly sensitive to storms, lake levels and changes in creek flow. The nearshore often includes small sand formations due to both littoral processes and channel shoaling at the mouth of the creek. Old Woman Creek State Nature Preserve managed by the ODNR Division of Wildlife is one of the Great Lakes’ two National Estuarine Research Reserves and includes a variety of coastal habitats interconnected with the lake.

East of Old Woman Creek the relief of the upland gradually increases to nearly 30 feet. The area is generally developed as residential or cottage communities separated by small agricultural areas. The bluffs are often fronted by narrow or transient beaches supported with a variety of small groins and other shore-perpendicular structures. Beach widths gradually decrease near the east end of the reach due to a reduction of sand resources downdrift of the shore-perpendicular structures at the mouth of the Vermilion River. The jetties at the Vermilion River were originally constructed in 1836 and have been lengthened and repaired several times. The structures have resulted in sand accumulation along updrift beaches and an overall decrease in sand supply near the east end of the region.



The width of the barrier beach at Sheldon Marsh State Nature Preserve varies yearly, seasonally, during storm events and over periods of time due to lake level fluctuations. Shown are high water levels after a Sept. 21, 2004, storm event (top), a Sept. 24, 2010, calm water day (middle), and a Dec. 7, 2010, ice accumulation (bottom).

Surficial Geology

The shore of the Cedar Point to Vermilion Region is an area of transition from the low-lying Cedar Point sand spit to lake plains with gradually increasing elevation to the east. The shore in this area is composed of deposits of shale, till, glaciolacustrine clay and sand.

From the west end of the reach to the NASA Pumping Station the shore is a barrier beach along the Cedar Point sand spit and Sheldon Marsh State Nature Preserve. From the NASA Pumping Station to the Huron River the shore transitions to low-lying lake plains with banks composed of glaciolacustrine clay and till extending up to 10 feet tall. East of the Huron River the relief of the upland increases to about 30 feet. The bluffs are composed of glaciolacustrine deposits and till over shale. The lower till and shale layers gradually become exposed to the east. The bluffs are broken by the floodplains of several creeks east of the Huron River.

Sand is the most common deposit in the nearshore, although mud and shale are also present. Sand deposits are greatest updrift of the large shoreperpendicular structures at Huron Harbor and at the northwest end of the Cedar Point sand spit. Sand deposits generally extend 500 to 1,000 feet offshore before exposing glacial till and till lag deposits of muddy sand and gravel. Sand deposits reduce to the first 100 feet offshore at the east end of the reach due to the structures at the Vermilion River. Shale is exposed in the nearshore in the Rye Beach area and east of Cranberry Creek. Mud is exposed lakeward of sand deposits near the Huron River.

Nearshore slopes are generally about 1 degree for the first few hundred feet and reduce to about 0.3 to 0.5 degrees farther offshore. Nearshore slopes are shallowest in areas with significant sand accumulation updrift of the Cedar Point Breakwater and Huron Harbor. Slopes become more variable near the east end of the reach due to the presence of 3 to 4 well defined sand bars extending up to 500 feet offshore. The sand bars typically extend from east of Old Woman Creek to near Sherod Park. Moderately well defined sand bars are also common updrift of the structures at Huron Harbor and along the Cedar Point sand spit.

Habitat

Conservation of fish and wildlife habitat, particularly along the nearshore, is a critical component of the LESEMP. The Cedar Point to Vermilion Region contains a variety of habitats such as sandy nearshore, beaches, coastal wetlands and low banks.

Prior to development, the shores of the Cedar Point to Vermilion Region contained a variety of complex habitats. The Cedar Point sand spit provided a complex, natural barrier beach system. The wider portions of the sand spit would naturally vegetate, accumulate sand and form low dunes. The east end of the Sandusky Bay gradually transitioned from open water to freshwater marshes and fens fronted by the barrier beaches in the area of Sheldon Marsh. The Lake Erie shore from Sawmill Creek to Old Woman Creek was generally mixed oak forests with small areas of prairie grasslands. Near Old



Vegetation is being planted in the sand along the barrier beach at Sheldon Marsh State Nature Preserve (left). Sand and a variety of pebbles and small stones comprise the beach at Old Woman Creek (middle). A mixture of small shale stones, sand and invasive mussel shells is found along the beach at Joppa Road (right).

Woman Creek the habitat transitioned to mixed mesophytic forests as bluff elevations increase and the glacial till soils reach the surface. As the area was developed the mixed oak and mesophytic forests were cleared for agriculture and eventual development.

The forests and coastal wetlands in this reach provide important habitat for both resident and migratory birds. The area from Cedar Point to the Huron River and the banks of the Vermilion River are designated as important bird areas by Audubon Ohio. Old Woman Creek is also noted as an additional significant bird habitat. In addition to the shore habitats, the shallow sandy nearshore lakebed was productive habitat and nursery areas for several native fish species, including walleye.

Habitats along the shore of the Cedar Point to Vermilion Region can be characterized as nearshore, beaches, coastal wetlands, banks and low bluffs.

Nearshore

The nearshore habitat of the Cedar Point to Vermilion Region is fairly consistent. The lake bottom typically consists of glaciolacustrine clay, glacial till and shale bedrock, covered by significant sand deposits closer to shore.

These substrates provide feeding and nursery habitats for fish and wildlife. The east end of the Sandusky Bay near Cedar Point provides important nursery habitat for walleye. The sandy Lake Erie nearshore also provides optimal habitat for adult walleye and yellow perch. Smallmouth bass are also common near hardened structures or the remnants of submerged groins in the nearshore.

Beaches

Beaches along the Cedar Point to Vermilion Region provide important yet fragile habitat supporting both flora and fauna. Supplementing beach flora with native vegetation is recommended throughout this region both to improve habitat and for erosion management to help stabilize the beach.

Coastal Wetlands

The Cedar Point to Vermilion Region contains protected coastal wetlands at Sheldon Marsh State Nature Preserve and Old Woman Creek National Estuarine Research Reserve. Coastal wetlands are also present throughout the east end of Sandusky Bay and at the mouths of several of the small creeks (including Chappel and Sugar creeks). These areas provide a variety of habitats for both aquatic and terrestrial species including shallow waters, wooded wetlands, coastal wetlands, cattail marsh and grasslands. Sheldon



American Water Lotus grow in East Sandusky Bay's shallow nearshore waters



Dune vegetation grows at the back of a natural sand beach in Huron



Coastal wetlands at Sheldon Marsh

Marsh provides habitat for up to 300 species of resident or migratory birds including warblers, waterfowl, shorebirds, wading birds, owls and raptors. The shores of Sheldon Marsh also provide habitat for a variety of plants and wildflowers. The other coastal wetlands in this region provide similar habitat but have not been as well documented.

Banks and Low Bluffs

Low bluffs begin in the Sawmill Creek area and gradually increase in elevation toward the east end of the region. The banks and low bluffs are often fronted by beaches. The low banks and bluffs support varied vegetation from grasses and sedges to herbaceous shrubs and trees. The bank vegetation also provides habitat for both resident and migratory bird populations.

Coastal Erosion

The Cedar Point to Vermilion Region is susceptible to a variety of types of erosion as the shore transitions from sand spit/barrier beach to low bluffs. The sand spit and barrier beach areas are primarily susceptible to erosion from wave action and weathering by wind, rain and ice. As the bluff heights increase to the east the shore also becomes susceptible to mass wasting. Wave action causes erosion in several ways. On sandy shores waves cause both alongshore and cross-shore littoral currents responsible for the erosion and accretion of beach sand and fine materials. Storm waves overwashing a barrier beach or sand spit can wash sand into the lagoon behind the beach,

where it becomes permanently lost from the littoral system. Waves reaching the glaciolacustrine clay and till bluffs will have a scouring effect on the shore. Sand and gravel suspended in waves can abrade materials making up the shore, especially softer materials such as clays. The waves breaking on the shore also releases energy that dislodges material from the shore and forces water into existing voids, widening the voids and forcing materials apart.

Surface water runoff and weathering, including wind and freeze-thaw processes, are also important factors contributing to erosion of the low bluffs in this region. Erosion at the toe of the bluff or between layers within the bluff can also result in mass wasting (slumping and collapsing) as the bluff heights increase in the eastern portion of the region.

Erosion and accretion along the shore of the Cedar Point to Vermilion Region has been considerably impacted by the development of the region. The construction of large shore-perpendicular structures at the tip of Cedar Point, Huron Harbor and the Vermilion River have significantly impacted the area. The original Huron River jetties were the first large structures to be constructed in the Cedar Point to Vermilion Region between 1827 and 1831. The structures immediately began trapping sand on the updrift beaches to the east. As sand accumulation continued the structures have required replacement and have been lengthened several times. The impounding of sand updrift of the structures has resulted in a deficiency to the west, leading to gradual erosion from the base of the Cedar Point sand spit to Huron Harbor.



The embayment at Sheldon Marsh is visible in this October 28, 2009 photo (left). A variety of revetments and seawalls have been built along the shore with the intention of preventing erosion as visible in this Month Day, 2012 photo (middle) and this Month 9, 2010 photo (right).

Construction of the original jetties at the mouth of the Vermilion River began in 1836. The jetties also began trapping sand on updrift beaches resulting in reduced beach widths at the east end of this region. The well defined nearshore sand bars in the eastern portion of the region disperse near Sherod Park and sand deposits are limited to the first few hundred feet from shore at the east end of the reach.

In 1897 the Cedar Point jetty was constructed to stabilize the tip of the sand spit and prevent sand transport to the Moseley Channel into Sandusk Bay. The jetty had a similar effect on littoral currents and immediately began trapping sand, significantly widening the tip of the Cedar Point sand spit. Excessive sand accumulation also required the Cedar Point jetty to be extended in 1922.

Erosion has also increased due to an overall reduction in material available to sustain beaches. Steady development along Lake Erie's shores has led to considerable armoring for structural protection and erosion prevention. The widespread prevention of erosion, however, reduces the amount of sand that enters the littoral system through mass-wasting. Transport of eroded soils into the lake from upland by rivers and streams is a second significant source of sand. This source, however, has been reduced due to dredging for the maintenance of navigation. For this reason, sandy dredge material should be placed in the littoral system when possible. Unfortunately, contamination from industrial and agricultural sources often requires dredge material to be placed offshore or in confined disposal facilities, permanently removing it from the littoral system.

The interaction of natural lake processes and gradual development of the shore has resulted in areas of consistent, slow-to-moderate erosion and accretion. Average recession rates from 1877 to 1973 were typically 1 to 3 feet per year downdrift of the structures at Huron Harbor and from Old Woman Creek to the Vermilion River. Average recession rates reached 3-5 feet per year in localized areas such as the mouth of Sawmill Creek or immediately downdrift of large groins constructed lakeward of residential communities. Areas updrift of the large shore-perpendicular structures in the area also experienced gradual accretion. By 1973 the tip of the Cedar Point sand spit had progressed approximately 1,500 feet lakeward. Similarly the beaches directly updrift of Huron Harbor experienced slow, consistent accretion.

To manage the erosion, groins have been constructed extensively in the beach areas from Old Woman Creek to the Vermilion River. Many properties in this area also have low revetments or seawalls as toe protection landward of narrow beaches. Groins were also constructed in the area



The west end of the Cedar Point jetty is shown with Goodtime in the foreground.



The west jetty of Huron Harbor which provides access to the lighthouse.



The Vermilion River west jetty and breakwater as seen from Main Street Beach.

from Sawmill Creek to the Huron River but have gradually been replaced by revetments and seawalls as sand beaches diminished in the area. The widespread armoring of the shore and lower recent water levels have resulted in an overall reduction in recession rates.

From 1973 to 1990, average shoreline recession rates from Cedar Point to the Vermilion River typically ranged from 0 feet per year to 8.1 feet per year, although recession rates reached 56.3 feet per year at Sheldon Marsh. Recession was greatest in unarmored beach areas (Sheldon Marsh) at the base of the Cedar Point sand spit and downdrift of the large shore-perpendicular structures at the Huron Harbor, such as the mouth of Turtle Creek (also known as Heimburger Ditch). As the shore continued to be armored, average recession rates from 1990 to 2004 typically ranged from 0 feet per year to 2.7 feet per year. Although recession at Sheldon Marsh still continued at up to 45.8 feet per year, some areas of the barrier beach experienced minor accretion as the beach was smoothed to its current embayed shape.

Future erosion along most of the Cedar Point to Vermilion Region will likely be limited to small unprotected areas or gaps between structures in the areas downdrift of the large shore-perpendicular structures. With adequate maintenance of the existing shore structures in this reach, future recession rates should be low along most of the region.

Flooding

In addition to the gradual recession due to erosion, the threat of lake-based flooding is a concern along the low-lying areas at the west end of the Cedar Point to Vermilion Region. The Cedar Point sand spit, barrier beaches at Sheldon Marsh and low banks from Sawmill Creek to the Huron River are all susceptible to flooding as well as erosion.

Floods have usually been associated with gales from the northeast, which may occur when tropical storms and the remnants of hurricanes eventually reach areas northeast of Lake Erie. The resulting winds, rotating counterclockwise around the storm center, may blow over many miles of open lake, piling water in the western basin. If the storm coincides with a period of high water, the effect is intensified.

During one such storm in 1972, high water and storm waves deposited sand and stone blocks on Cedar Point Road, blocking it. The tongues of sand extending into Sandusky Bay on which Sunset Drive, Greenbrier Lane and Bayshore Drive are developed, are actually remnants of storm deposits that occurred in the distant past, before settlement and development. The barrier beach at Sheldon Marsh also has a significant history of breaching during periods of high lake level, making the area especially vulnerable to flooding.

The risk of flooding is increased in the heavily developed areas along Cedar Point Road and from Sawmill Creek to the Huron River. Many residential structures were constructed very close to the shore in these areas, increasing the threat of property damage from lake-based flooding.



Large waves can form during or after high winds and storms as seen above: along the east side of the revetment protecting the NASA Pumping Station (left), looking west from Lake Front Park in Huron (middle) and looking east from the Old Woman Creek beach toward the shore north of the Oberlin Beach community.

Needs Assessment

A needs assessment was performed in 2006 and 2007 to gather information from coastal property owners and local officials about their knowledge and perceptions of Lake Erie coastal erosion. The needs assessment included mail/internet surveys and focus groups. Surveys were sent to both public officials and lakefront property owners. Statewide 243 property owners and 140 public officials responded to the survey. Survey respondents were asked to provide their zip code to help identify the erosion characteristics and needs of their community. Nine public officials and 51 property owners responded from the zip codes included in the Cedar Point to Vermilion Region (44870, 44839, and 44089). It should be noted that the Sandusky (44870) and Vermilion (44089) zip codes include portions of the Sandusky Bay shore and the shore from the Vermilion River to the Erie/Cuyahoga county line that are not included in the LESEMP Cedar Point to Vermilion Region.

Three focus groups were held in Bay Village, Painesville and Port Clinton. Based on meeting proximity, it is expected that property owners or officials from the Cedar Point to Vermilion Region participated in the Port Clinton or Bay Village meetings. Overall, the meeting participants understood the effects of erosion and were in favor of technical assistance or written best management practices to better inform those affected.

To supplement information gained from the initial LESEMP needs assessment several meetings were held in the Cedar Point to Vermilion Region. Public officials from Erie County, the city of Sandusky, Huron



When sand is present, natural beaches are the best form of erosion protection and have the added benefit of providing recreational opportunities.

Township, the city of Huron, Berlin Township, Vermilion Township and the city of Vermilion were invited to participate. An additional meeting was scheduled for the general public with all lakefront property owners within the region boundaries invited to attend.

Top Priorities for Shoreline Property Owners

According to shoreline property owners along the Cedar Point to Vermilion Region, the following are their top priorities with regards to erosion issues and control measures:

1. Providing information on a variety of erosion control methods. Property owners requested that several potential options be provided for erosion management to give shoreline property owners the information necessary to select measures appropriate for their property and budget.
2. Providing an explanation of detached breakwaters and factors that increase or limit their effectiveness. In particular shoreline property owners were interested in specific areas where detached breakwaters would be effective.
3. Providing an explanation of sand transport and erosion processes at Sheldon Marsh.

Top Priorities of Local Public Officials

Overall public officials in the Cedar Point to Vermilion Region were receptive of the LESEMP program and glad LESEMP resources were available for their communities. The most notable concerns from public officials in the Cedar Point to Vermilion Region include:

1. Communicating to the public that ODNR has information available to assist property owners with erosion issues. Concerns were related to the impression that ODNR is a regulatory agency and the ability to represent the LESEMP program as technical assistance separate from ODNR regulatory authorities.
2. Explaining sediment transport along the Cedar Point to Vermilion shore, particularly in complex areas such as Sheldon Marsh. A concise and understandable explanation of sediment sources, transport and sinks would be helpful for those living in the region.
3. Using proactive approaches to get the LESEMP information out to the public to increase adoption of the recommendations and best management practices.

Recommendations

To better provide recommendations for the various coastal conditions within the Cedar Point to Vermilion Region, the region has been segmented into six reaches. Each reach contains introductory material on the coastal setting of the reach, followed by a set of recommendations specific to the reach. For more information on the recommendations, please refer to Appendix A.

The reaches for the Cedar Point to Vermilion Region are:

- Reach 01: Cedar Point Sand Spit (including lake and bay shores)
- Reach 02: Sheldon Marsh
- Reach 03: NASA Pumping Station to Huron River
- Reach 04: Huron River to Old Woman Creek
- Reach 05: Old Woman Creek to Joppa Road
- Reach 06: Joppa Road to Vermilion River

The sections for each reach are designed so that they can be read individually or as part of this chapter. Additionally, the reaches do not have to be read in any order as they do not reference information from other reaches.



The land where Point Retreat (left side of photo) now sits used to directly connect with the barrier beach at Sheldon Marsh State Nature Preserve before rapid shore recession eroded the beach more than 1,000 feet in some places into a giant “C” shape. To learn more, see Cedar Point to Vermilion Reach 02 for more.

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Learn More:

LESEMP Webpages: ohiodnr.com/tabid/20501.default.aspx

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