



Living on Pennsylvania's Lake Erie Coast

FACT SHEET

Pennsylvania Sea Grant, as part of the National Sea Grant Program, promotes efforts to improve the environmental and economic health of Pennsylvania's coastlines.

Focusing on the Lake Erie and Delaware River watersheds, Pennsylvania Sea Grant works to increase public awareness of coastal environmental and economic issues through extension, communication, applied research, and education activities.

The National Oceanic and Atmospheric Administration (NOAA) administers the National Sea Grant College Program. Pennsylvania Sea Grant is also supported by the Pennsylvania State University and the Commonwealth of Pennsylvania.

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ISSUES AND ANSWERS

Lake Erie shoreline and bluff property in Pennsylvania is scarce and in high demand for residential development. The desirability of beautiful views, moderated weather and access to the lake must be weighed against hazards from bluff recession, shoreline erosion, and flooding.

Potential buyers should be aware that dynamic and rapidly changing forces affect the property they're planning to acquire, and educate themselves accordingly. Don't only rely on property disclosure requirements.

WHAT ARE THE HAZARDS?

Hazards fall into two major categories:

- Shoreline erosion and flooding
- Bluff recession.

SHORELINE EROSION AND FLOODING

Erosion and flooding potentials depend greatly on fluctuating lake levels and the amount of beach material along the shoreline. Wind-driven waves, especially during periods of high lake levels, can inundate natural protective beaches and allow water and damaging waves to reach the back beach areas where residences are located. During prolonged periods of inundation, large quantities of beach material can be moved temporarily offshore. It is during these periods that the greatest threat of property damage and site instability occurs. Along stream valleys and ravines, additional flooding threats come from stormwater runoff in the upper watersheds.

Lake Erie is the shallowest of the Great Lakes, reaching a maximum depth of 210 feet in the eastern basin. The lake topography coupled with changing water levels can have extreme effects on the shoreline. Because the lake is shallow, the effects of storm driven waves are amplified. The axis of the lake runs from southwest to northeast, corresponding to the direction of prevailing winds. Strong winds can push water toward one end of Lake Erie (setup) and may create a difference in elevation of over 15 feet. When the wind stops, the water will rebound (seiche effect) causing the water to move back and forth across the lake. Strong winds or northeasters can also be a problem, driving storm waves opposite of their normal path.

Water levels continue to fluctuate in the Great Lakes. Man-made effects on levels are slight. For instance, construction of the Welland Canal, which bypasses Niagara Falls dropped the level of Lake Erie by approximately four inches. Most fluctuation is due to changes in input from the upper Great Lakes watershed, which contributes almost 90

percent of the total input into Lake Erie. The rest of the water enters from tributaries, groundwater, and precipitation.

Lake Erie water levels reached record highs in the mid-1980s and near-record levels from 1996 through 1998, affecting shoreline residents and public utilities. Just one year later, the lowest point in the past 30 years was reached, nearly a four-foot difference. In a typical year, the lowest levels occur in February, the highest in June.

BLUFF RECESSION

The high coastal cliffs overlooking Lake Erie are called bluffs (*see figure 1*) and can range in height from 5 feet to nearly 200 feet above lake level. The bluffs, for the most part, are unconsolidated glacial soils comprised of sand, gravel and clay. About 20 percent of the bluffs have a lake level shale bedrock exposure with a thickness ranging from barely visible above lake level to a height of 20 feet. Outside the armoring effect of the shale, the unconsolidated soils of the bluffs are highly erodible when exposed to the forces of direct wave contact, groundwater flows, surface water runoff, ice, wind and rain.

The vegetation mat that normally covers the bluff face helps protect the erodible soils and keeps them intact. During periods of high lake levels, wave damage can occur at the base of the bluff, remove the lower vegetation, and cause the remaining mat to slide and separate. Human activity, such as building footpaths or cutting the tree canopy, will also disturb the vegetation mat. Upon its disturbance or removal, the forces of erosion will further destabilize the bluff, causing substantial volumes of bluff material to collapse and slide into the lake. Such erosion, known as bluff recession, eventually causes the bluff crest to recede inland (*see figure 2*).

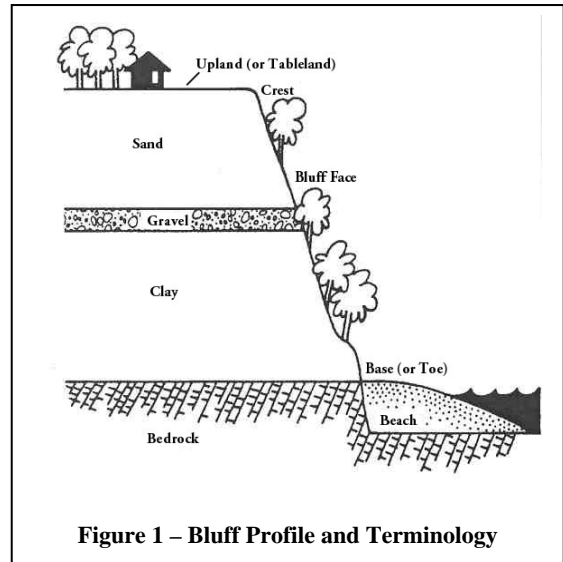


Figure 1 – Bluff Profile and Terminology

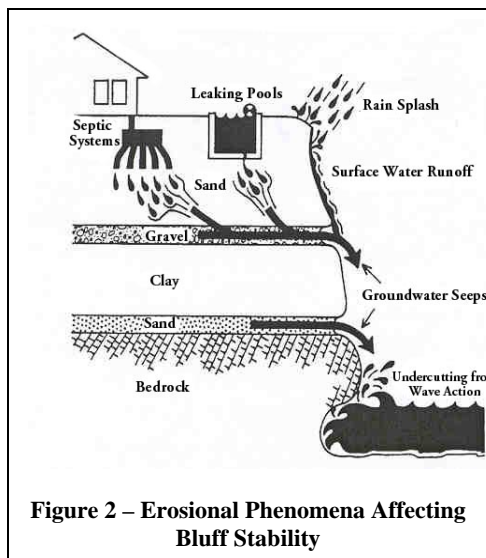


Figure 2 – Erosional Phenomena Affecting Bluff Stability

The average rate of bluff recession in Pennsylvania is one foot per year. During the past two decades of monitoring, losses up to 20 feet in a single year have been recorded in specific locations. Bluff recession is a natural force, and by its own nature is not a problem. However, when homes and other structures are placed too close to the bluff crest, bluff recession becomes a serious threat to the structural integrity or long-term usefulness of these structures. Bluff recession does cause property loss and can be a threat to public health and safety.

Groundwater and stormwater are other factors that can affect bluff stability and rates of bluff recession. Ice movement and cycles of freezing and thawing can exaggerate this effect. Groundwater occurs naturally on most bluff properties along Lake Erie. Excessive groundwater flows may cause bluff instability and soil movement when more water is present than the vegetation mat can remove through evaporation. Super saturation of sandy, clay or gravel soils can cause soil on the bluff face to flow or slump.

Stormwater includes on-lot flows from structures, such as downspout discharges and impervious surface runoff. It also comes from off-site watershed sources and is increased by buildings, roads and parking lots. Stormwater that is directed onto a bluff property will usually cause instability problems, as flows exit over and through the bluff face. Stormwater that is directed to intermittent watercourse ravines will accelerate deepening of the watercourse bed and cause the ravine walls to collapse, widening the ravine valley. This may reduce the area of useable land for the placement of a residence.

WHAT HELP IS AVAILABLE?

There's much to know about living along Pennsylvania's Lake Erie Coast. Whether you plan to live near the crest of the bluffs or directly on the shoreline, help is available. While sellers, real estate agents, real estate appraisers and neighbors are all possible sources of information, an on-site inspection before purchase may help answer questions and determine potential problems.

The Department of Environmental Protection's (DEP) Coastal Zone Management (CZM) Program offers a unique service to coastal property owners, providing professional technical assistance at no cost. Current procedures require owners or sellers to ask for this service in writing, so prospective buyers interested in potential coastal hazards should ask sellers to make the request for a report.

Advice is available on a variety of issues:

- Use of best management practices (BMPs) to improve shoreline or bluff stability.
- Improving bluff stability through use of vegetation.
- Building and maintaining shoreline protection structures.
- Controlling stormwater and groundwater.
- Knowing the rules, design considerations, and required permits.

Because of public health and safety concerns, development of coastal properties may be governed by local zoning requirements. They may be subject to requirements of laws such as Pennsylvania's Bluff Recession and Setback Act (BRSA), Flood Plain Management Act, Stormwater Management Act, or Dam Safety & Encroachment Act. Know if your property is located in a bluff recession hazard area or a flood plain.

WHAT QUESTIONS SHOULD I ASK?

A property may be located on a high bluff overlooking Lake Erie, or along a stream or ravine leading to the bluffs and shoreline. Prospective owners have to consider several issues in deciding how to build, renovate or protect new or existing structures, and determine what options are available for combating bluff recession, shoreline erosion and flooding

- Is there any danger from bluff recession, erosion, or flooding?
- Is the base of the bluff protected against wave attack?
- How close to the crest of a bluff can structures be built?
- Is it possible to drain surface and groundwater away from the bluff to help stabilize it and what techniques are available?
- Can vegetation be utilized to help prevent surface erosion?
- What actions are the most cost effective in protecting a specific property?
- What laws and regulations govern use of coastal properties and affect placement of structures?
- In the absence of laws and regulations, what actions will a prudent owner take?
- Is there space for adequate on-lot sewage disposal?

Insurance is another issue to consider. If damage doesn't have a direct relationship to a storm event, flood insurance may not cover property losses from bluff recession. However, insurance may be available if structures are in a flood plain. Potential property owners can contact local authorities to determine if the community participates in the National Flood Insurance Program and if they will be located in a flood plain. If so, policies are available through local insurance agents.

A variety of local, state or federal permits are usually required for coastal construction, stream modification, wetlands displacement, or shoreline protection activities. For instance, the BRSA establishes municipally administered setback requirements for structures and strictly limits construction activities on the bluff face.

Even if allowed, steps and trails on the bluffs involve serious design considerations and professional help is advised. If shoreline protection or other structures will encroach below the ordinary high water mark (OHWM) of 573.4 ft, a U.S. Army Corps of Engineers and DEP joint permit is required. In addition, if shoreline protection or other structures extend below the ordinary low water mark (OLWM) of 569.2 ft., a submerged lands license agreement is required from DEP. On private property above the ordinary high water mark, local permits may apply.

WHAT CAN I DO ABOUT COASTAL HAZARDS?

Where erosion is severe, shoreline and bluff property owners have a wide range of options.

- Moving the structure inland or elevating it above potential flood crests can be economically and technically feasible methods to "buy" more time in face of the inevitability of the coastal processes at work.
- Constructing structural barriers to combat erosion, such as groins, revetments, breakwaters, and seawalls, may be costly, with the least expensive structures typically costing \$200 to \$400 per linear foot of shoreline. Successful shoreline protection projects have been built by groups of homeowners sharing costs and working through qualified contractors.
- As mentioned above, all structures require a permit if located below the OHWM, or a submerged lands license if extended below the OLWM. Periodic maintenance requirements for any structures should be anticipated and are normally required by the permit or license. The best opportunity to conduct maintenance or build structures is during times of lower lake levels. Unfortunately, property owners are less concerned about shoreline protection structures during such periods, since the perceived threat is low.
- Since structural solutions to shoreline erosion, bluff recession and flooding often create new problems, accomplishing less intrusive protection through beach nourishment and use of native vegetation may be preferable.
- Controlling stormwater and groundwater can affect the rates bluff recession.
- Doing nothing, accepting the geologic processes at work, is also a choice.

WHOM SHOULD I ASK?

A good first step is to contact CZM staff directly (814) 332-6942, or write to CZM at the Northwest Regional Office of DEP, 230 Chestnut Street, Meadville, PA 16335-3481. The fax number is (814) 332-6121. The central office number in Harrisburg is (717) 787-5259. Basic information on coastal processes is available on DEP's web site (www.dep.state.pa.us); choose **Subjects**, then **Coastal Zone Management**.

Information about living on Pennsylvania's Lake Erie coast is available from many other public partners in coastal protection and management, as well as a wide variety of nonprofit and private interest groups. Some of these partners include DEP's Office of the Great Lakes and other programs located in the Northwest Regional Office of DEP in Meadville, Erie County Department of Planning, Erie County Department of Health, municipal zoning and code enforcement personnel, Erie County Conservation District, Pennsylvania Game Commission, Pennsylvania Fish and Boat Commission, Great Lakes Commission and US Army Corps of Engineers.

Pennsylvania Sea Grant and CZM are both affiliated with the National Oceanic and Atmospheric Administration. They have a joint interest in a thriving coastal economy; increased understanding of Lake Erie and its shoreline; and a healthy, restored and protected environment. Enjoy the views, climate and spectacular sunsets, but take the time to understand the dynamic forces that affect your home.

This fact sheet was produced in conjunction with CZM.

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