OHIO COASTAL MANAGEMENT PROGRAM
COASTAL EROSION AND FLOODING

Uses Subject to Management

- Construction or redevelopment of permanent structures in Lake Erie coastal erosion areas.
- Construction of erosion control structures.
- Development in coastal and riverine flood hazard areas.
- Construction of dams, dikes and levees for flood control.

Erosion

Erosion along the Ohio shore of Lake Erie is a serious problem, requiring increased attention and effective action by the state. Each year, nearly 1.6 million tons of material is eroded along Ohio's lakeshore, with significant and far-reaching implications for public safety, health and welfare. Record-high lake levels in the early 1970s and again in the mid 1980s caused extensive damage to residential, commercial, industrial and agricultural property. Beaches were inundated by high lake levels and eroded by waves, leaving structurally unprotected bluffs more vulnerable to wave erosion. Erosion of dikes and barrier beaches exacerbated wetland loss, negatively affecting coastal wildlife populations, overall water quality and the natural capacity of the environment to absorb flood waters.

Of the estimated 1.6 million tons of material eroded along the shore each year, only about 20 percent is sand-sized sediment that remains along the shoreline. The remainder is fine-grained sediment that disperses in the lake, increasing water turbidity and sedimentation rates. Increased turbidity reduces recreational opportunities and increases treatment costs for public water supplies. Increased sedimentation disrupts valuable aquatic habitats, hurting fishery resources and the commercial and recreational fishing industries they support.

The effects of erosion on the Ohio shore of Lake Erie have been documented by the Division of Geological Survey. Field studies examined the modern physical setting (e.g., shore stratigraphy, shore relief, shore orientation, beach width, nearshore slopes, nearshore sediment, wave climate) and cultural setting (e.g., land use, shore protection structures) that influence the rate of shore erosion and recession, both temporally and geographically. Historical charts and aerial photographs document temporal changes in the physical and cultural settings.

A century ago, sand beaches fronted most reaches of the Ohio shore of Lake Erie. Along the high-bluffed shore east of Cleveland, the beach was used as a roadway by settlers coming to Ohio. Today, many beaches have been eroded. Where beaches remain, they are narrow and segmented and provide little natural protection from erosion. In their place are numerous (approximately 4,000) erosion control structures built to protect urban development.

The shore of Lake Erie varies considerably in relief and composition. Eastward from Toledo to Huron, the shore consists of low-relief clay banks, sandy barrier beaches, or armor-stone dikes, except for the rock-bound shore in the Marblehead-Catawba Island area. From Huron to Conneaut, the shore consists of 20-to 65-foot-high bluffs of till and/or bedrock. Easily eroded materials (sand, clay and till) make up about 75 percent of the Ohio lakeshore.

The two principal erosion processes are wave erosion and mass wasting (Carter, Benson and Guy, 1981; Carter and Guy, 1988). Most wave erosion occurs during spring and fall storms, when the greatest amount of wave energy is expended along the shore. The amount of mass wasting of the upper bluff material is largely dependent upon the frequency and amount of wave erosion at the bluff toe. As the bluff toe erodes, the profile steepens, inducing mass wasting in the upper bluff.

Although much of the Ohio lakeshore is composed of materials easily eroded by waves, erosion rates vary over time and from place to place. Natural factors such as shore composition, beach distribution, nearshore depths, storm frequency, lake level and shoreline orientation contribute to these variations. Man-made erosion control structures and offshore disposal of sand dredged from harbors also contribute to these variations and often aggravate existing or create new erosion problems.

The OCMP recognizes that along some reaches, erosion control structures have slowed erosion with minimal apparent adverse impact, while along many other reaches, armoring the shore has been detrimental. Despite adverse impacts associated with some erosion control structures they are an integral part of the Ohio lakeshore. Without them, many of the buildings located near the bluff edge would now face an even greater threat from erosion. The OCMP promotes proper design of new erosion protection structures and recognizes the benefits of nonstructural erosion control measures and combinations of structural and nonstructural measures. Recognizing the merits of nonstructural erosion control measures, Ohio has selected five shoreline properties "otherwise protected" by public ownership as additions to the federal Coastal Barrier Resources System (CBRS), thereby protecting the existing natural barriers and the adjoining aquatic and upland habitats. This brings to 10 the number of units in the CBRS. The "otherwise protected" areas are Sheldon Marsh, Old Woman Creek, Kelleys Island North Pond, Mentor Marsh/Headland Dunes and Arcola Creek. These areas will help demonstrate the value of natural barriers and nonstructural shoreline stabilization measures designed to mimic, enhance or restore natural stabilization systems.

For many years, numerous agencies, organizations and experts have warned that continued exposure of public and private investments to the risk of natural hazards, including coastal erosion, has widespread deleterious impacts upon state, local and national economies. Despite erosion and flooding risks, more than 85 percent of Ohio's shorelands are developed, and development is expected to continue.

Erosion-related damages on the Great Lakes were estimated at $290 million in 1985 and 1986 (DeCooke) and at $9 million in 1985 in Lake County, Ohio. Losses cited by the Lake County Planning Commission include loss of real estate structures, real estate value, private protection

expenditures, public protection expenditures and loss of real estate tax revenues, all typical losses suffered by the public and by private individuals when development is exposed to erosion risks.

Without exception, those who warned of the consequences have repeatedly urged that the most effective and fiscally responsible means to ameliorate losses to public and private investment is to encourage the location of development out of harm's way. Guiding development outside risk areas reduces costs to the general public through higher insurance premiums, direct emergency reimbursements or low-cost loans for damages, and replacement of public infrastructure.

Under the OCMP, identification of Lake Erie coastal erosion areas and control of new permanent structures through state or local permits will improve decisions by shoreland property owners and developers (see Policy 1). The coastal erosion area program will reduce property damage through hazard avoidance. In addition, proposed erosion control measures will be reviewed to help ensure their effectiveness and to eliminate or minimize potential adverse impacts on coastal processes and the adjacent lakeshore (see criteria under Policies 1 and 2). And lastly, by designating units of the federal Coastal Barrier Resources System as Special Management Areas (see Chapter 6) the OCMP is promoting the protection of other natural features along the coast and promoting the use of nonstructural measures for erosion control where practicable.

Erosion is a natural process that never will be eliminated entirely. Despite the obvious hazards and the knowledge of potential for erosion, construction has continued within known high-risk erosion areas. Erosion control structures are not feasible or cost effective in some areas along the shoreline. Other management approaches involving building and zoning regulations must be considered. Basic coastal erosion area information must be provided to developers and potential shorefront owners. More importantly, they must use such information to make intelligent decisions. Increased efforts are needed to provide this information and to offer management assistance. Pursuant to Ohio's Coastal Management Act of 1988, preliminary maps identifying land anticipated to be lost to erosion over a 30-year period have been distributed to local jurisdictions for public inspection. Coastal erosion areas were identified according to uniform and well-established scientific protocol, in accordance with administrative rules adopted in 1991 and substantively amended in 1996. A permit for construction, erection or redevelopment of any permanent structure within a coastal erosion area will be required in accordance with the Coastal Management Act. Construction will be allowed within such areas with provision for effective erosion control measures. The expected outcome is to encourage wiser choices regarding development in coastal erosion areas, creating an incentive to develop further from the shore.

Flooding

The destructive capacity of lake and riverine flooding in Ohio's Lake Erie coastal area has also been observed and documented. A 1977 ODNR report, *Coastal Hazards: Erosion, Recession and Flooding*, outlines the causes and effects of flooding and describes the critical nature of the area where lake and riverine flood waters meet. Previous studies have detailed the results and damages from particular occurrences on a localized basis. In addition, the U.S. Geological Survey in 1974 prepared a series of maps of flood prone areas for the entire Ohio Lake Erie basin at the request of the 89th Congress as expressed in House Document 465. These maps are on file with the U.S.

Geological Survey and ODNR's Division of Water. The U.S. Army Corps of Engineers prepared a *Report on Great Lakes Open-Coast Flood Levels* in 1977 and a *Revised Report on Great Lakes Open-Coast Flood Levels* in 1988. Both studies were prepared for the Federal Emergency Management Agency (FEMA), which, in administering the National Flood Insurance Program (NFIP), provides detailed flood hazard information to all designated and participating communities.

While the areas subject to flooding are reasonably well known, the timing and occurrence of such flooding along the lake is highly unpredictable, often resulting from sudden storms and short-term fluctuations in barometric pressure. More predictable flooding along rivers and streams takes place in the spring when rainfall and snowmelt occur, the ground is either saturated or frozen, and runoff is high. Ice jams also compound the flooding problem at these times.

In the late 1960s, direct flood damages in Ohio averaged $20 - $25 million annually. Today, annual damages have escalated to more than $100 million and are expected to rise even further. Again, despite the availability of data that recommends the contrary, development has continued to occur on Lake Erie's flood hazard areas. One reason for this is that many people mistakenly believe that federal expenditures on flood control devices have eliminated the possibility of severe flood damages. Although such structures have prevented some damage, they cannot offer complete protection against all floods. Furthermore, the federal government will not finance projects that cost more to build than the value of properties they are designed to protect. Flood damages also increase when flood protection structures interfere with the free flow of water. Water backs up or is diverted onto properties that were previously flood free. Paved and built-over areas and the loss of natural protective systems like wetlands compound flooding by concentrating rainwater runoff that results in an increase in floodwaters.

The shortcomings of a flood protection policy based solely upon physical structures have become apparent. The current trend is to focus on nonstructural alternatives such as floodplain regulations, flood proofing, wetland preservation, stream management and public acquisition of floodplain lands. Although such strategies can reduce potential flood damages, they are often difficult to implement. This difficulty is primarily due to a confusing combination of building codes, zoning regulations and NFIP Standards that, at times, contradict one another and result in enforcement problems. Public administrators have lacked a unified management plan that coordinates the various activities of agencies with responsibilities pertaining to floodplain management.