

**PART II**  
**Michigan Coastal**  
**Management**  
**Program**



## Chapter II

# Michigan's Coastal Area and Its Character

*More than 39,000 square miles of the Great Lakes and 3,200 miles of Great Lakes coastline are within Michigan's coastal boundaries — giving the state the longest freshwater coast in the world.*

*Throughout history, the Great Lakes and the resources they support have been important to Michigan. Fish, furs, fertile land and lumber first attracted settlers who built towns along the coast and used the Great Lakes to transport their harvests to other parts of the growing nation. A century later, loggers chopped their way through virgin timber, floating their logs to boom towns along the coast. Logging and fishing were soon replaced by manufacturing industries which concentrated along the coast to use the lakes for shipping and processing. As the automobile industry flourished, workers traveled away from cities to vacation at coastal beaches and resorts. Improved roads and freeways shortened travel time between industrialized cities and the coast, making it possible for more people to enjoy seasonal or permanent residences on the Great Lakes.*

*Today, we continue to depend on the coast for our livelihood and recreation. Coastal lands support industry, recreation, residential areas, resorts, forests, farms and orchards, energy and mining facilities. Coastal waters support commercial navigation, fisheries, recreational boating, waste assimilation, industrial and public water supplies.*

*The following pages of this chapter describe important characteristics of Michigan's coast including coastal use and development, shoreline ownership, and geomorphic shore types. The geographic limit of the coast is then defined, using more specific use and geomorphic ownership patterns. The resulting coastal area boundary defines the focus of Coastal Management Program funding efforts and technical services.*

### **CHARACTER OF THE COAST**

The first portion of this chapter describes the important characteristics of Michigan's 3,200 mile coast including: (1) a description of the coastal area by regional boundaries; (2) shoreline ownership; (3) coastal use and development; and (4) geomorphic shore types.

## Coastal Character — Regional Boundaries

Following is a description of coastal characteristics for each of Michigan's ten coastal planning and development regions. This discussion demonstrates that coastal uses, developments and physical characteristics vary greatly along our 3,200 mile coast. Figure II-A illustrates the boundaries of Michigan's coastal planning and development regions.

### *Region 1*

In southeast Michigan, officials of numerous state and federal agencies, four counties (Macomb, Monroe, St. Clair and Wayne), and at least 36 minor civil divisions regularly make decisions concerning coastal resource use. The coastal resources over which these public officials exercise their authority have diverse characteristics.

Portions of Lake Erie,\* Lake Huron and Lake St. Clair and the Detroit and St. Clair Rivers are resources defined as coastal waters in southeast Michigan. These bodies of water support a variety of fish and wildlife with shallow areas acting as breeding, feeding and nursery areas.

Individuals also rely on these coastal waters. Many communities and industries draw their water supplies and discharge treated wastewater to these lakes and rivers. They are used for transporting raw materials and goods into and out of the region. Finally, these coastal waters are heavily used for recreational purposes.

The Detroit metropolitan area is heavily dependent upon the coast for recreation, shipping, industry and other uses. The entire Wayne County waterfront has been identified as an area of particular concern. Current efforts are being directed toward providing more opportunities along the Detroit waterfront for recreation.

The uses of the region's shorelands are also varied. The shorelands are dominated by homes, with industrial development distributed throughout its length. Commercial and recreational facilities account for a portion of the shorelands in the region as do wetlands that serve as nesting and feeding areas for waterfowl.

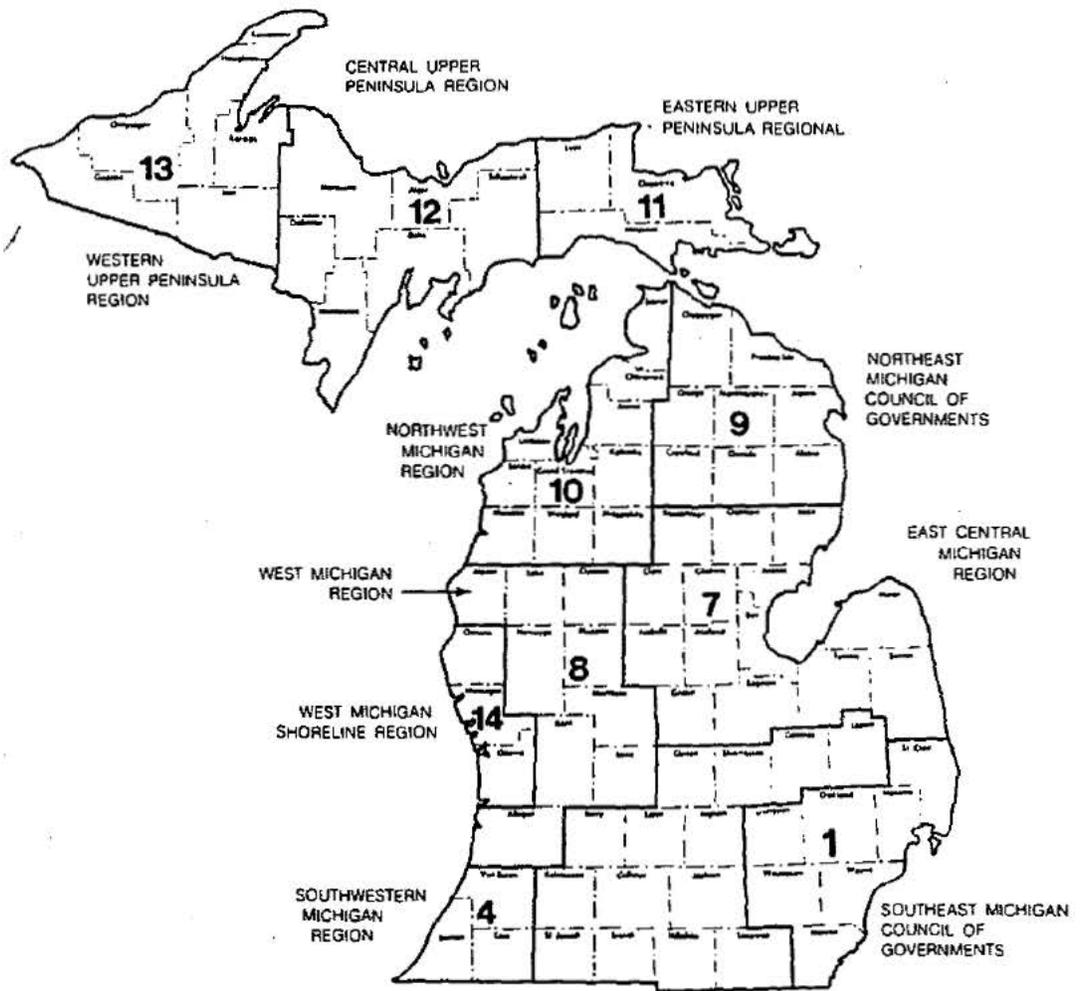
### *Region 4*

Within the southwestern Michigan region, the two counties of Berrien and Van Buren border Lake Michigan. Berrien County's six townships, four cities, and three villages encompass about 42 linear miles of coastline; while Van Buren County's two townships and one city cover approximately 13 linear shore miles. Major urban centers include the cities of New Buffalo, St. Joseph-Benton Harbor and South Haven.

Sand beaches, bordered by clay bluffs and sand dunes are characteristic of the Lake Michigan shoreline in this region. The several hundred acre Grand Mere area,

\*Nearly all of Michigan's share of Lake Erie shoreline is located in Monroe County. Shore types of this shoreline vary, but basically consist of wetlands interspersed with artificial shore types in and near the more developed areas. Residential development accounts for 15 miles or about 50 percent of the total shorelands use of the Michigan portion of Lake Erie frontage. About 11 miles, (or 33.8 percent) of Michigan's Lake Erie shorelands are state owned designated recreational and wildlife areas. Agriculture and vacant, undeveloped lands account for about 5.8 miles of shoreline. The Monroe Port area, Erie State Game Area, Sterling State Park, and Erie State Game area islands are some of the many areas of particular concern which have been identified in this important area. (Coastal Zone Management, July 1976, Monroe County Planning Department and Commission).

FIG. II-A  
Coastal Regional Agency Boundaries



adjacent to the lake in Berrien County, is one of the region's most valuable assets. The area illustrates a variety of habitats, including woodlands, wetlands, inland lakes, sand dunes, and beach and serves as a valuable nature study area for local and state residents. The Thunder Mountain area in southern Van Buren County is another of the region's major natural resource sand dune areas.

Demands for the use of shore areas continues to increase — particularly demands for recreational and residential uses, and commercial and industrial uses. Historically, there has been little regulation and guidance of often competing, conflicting and sometimes adverse uses of shoreland areas. For example, lack of location and density standards for residential developments along the coast have at times contributed to severe private and public property loss and damage caused by shoreline bluff erosion.

### *Region 7*

The east central Michigan region includes the coastal counties of Iosco, Arenac, Bay, Tuscola, Huron and Sanilac. The larger urban communities in this region include Oscoda, East Tawas-Tawas City and Bay City.

Located within the region are valuable wetlands with significant fishery and wildlife values. The Saginaw Bay area, which borders the majority of the region's coastal area, is one of the most productive habitats for fish, waterfowl and fur bearers on the Great Lakes.

Saginaw Bay has a number of islands. One of the most significant is Charity Island. The island's lighthouse has served as a navigation aid since 1857. It has also served in the past as a place of refuge for the ship-wrecked and storm driven.

The shore of the region is quite different from that of Lake Michigan and Lake Superior. The bay area is characterized by wetlands, while the lower areas of the region are characterized by sandy beaches, backed by low bluffs. One stretch along the eastern shore of Huron County consists of exposed bedrock and rocky shorelands, contributing to the picturesque beauty of the area.

### *Region 8*

The west Michigan region consists of Allegan and Mason counties. Urbanized areas in the region include Ludington, Holland and Saugatuck-Douglas. The shoreline in this two county area is characterized by high clay bluffs and sand dunes, with some excellent swimming beaches. The high rolling dunes with blow-out areas add much to the scenic beauty of the coastline. North of the City of Saugatuck, the rolling dunes are interrupted by the mouth of the Kalamazoo River. The booming lumber town of Singapore was founded near the river mouth in the 1830's and has long since been buried beneath the sand of Lake Michigan.

## *Region 9*

The four Lake Huron counties in the northeast Michigan region consist of Alcona, Alpena, Cheboygan and Presque Isle. The larger shoreline communities include the cities of Alpena, Cheboygan, Harrisville and Rogers City. There are 15 townships and one village along Lake Huron in the region. The northeast Michigan coast is comprised of about one-third sandy beaches, one-third marshy wetlands and one-third rocky outcrops.

Beautiful scenic sites can be found along the US-23 highway which follows the region's shore. Attractions in the coastal area include the Old Presque Isle Lighthouse, Besser Natural Area, Misery Bay, and, of course, the Mackinaw Bridge.

Northeast Michigan has a stable shoreland's economy in quarry operations and cement production. The region has the distinction of having the world's largest cement plant, located north of Alpena, and the world's largest limestone quarry, near Rogers City. Quarry operations, utilizing high quality metallurgical and chemical grade limestone deposits, are located at three sites along the coast between Alpena and Rogers City. There is considerable acreage of proven limestone reserves of similar quality contiguous to the shoreline being held for future development. All of these industrial activities are complemented by Great Lakes shipping and port facilities.

Northeast Michigan also offers many recreational opportunities. Tourism plays an important role in the economic structure of the entire region. The three state parks of Harrisville, P. H. Hoefft and Cheboygan are major recreational facilities located along the shores. In addition, the Thunder Bay bottomlands, off Alpena, have one of the highest concentrations of shipwrecks on the Great Lakes bottomlands.

## *Region 10*

The northwest Michigan region encompasses Emmet, Charlevoix, Antrim, Grand Traverse, Leelanau, Benzie and Manistee counties. The urban areas in the region include Manistee, Frankfort, Traverse City, Charlevoix and Petoskey.

The high recreational value of the Lake Michigan shoreline in this region has resulted in much development oriented toward recreation. The famous Sleeping Bear Dunes area in Leelanau County has been established as a National Lakeshore. Six state parks and numerous county, township and city parks also provide recreational opportunities.

The shoreline of the area is irregular, consisting of several bays and points. The most notable are Grand Traverse Bay, Little Traverse Bay, Big and Little Sable Points, Point Betsie and Waugoshance Point.

Two major island groups are located within the Lake Michigan waters of the region — the North and South Manitou Islands and the Beaver Island group.

### *Region 11*

Chippewa, Luce and Mackinac counties constitute the eastern Upper Peninsula region. The region is bordered by three of the five Great Lakes — Michigan, Huron and Superior, and by the St. Marys River. The Soo Locks at Sault Ste. Marie permit vessels to bypass the shallow rapids of the St. Marys River and handle more water-borne tonnage annually than any other lock system in the world.

The three counties have Great Lakes shorelands encompassing 722 linear miles, including over 300 miles of island shoreline. Larger islands are Neebish and Sugar Island in the St. Marys River, Les Cheneaux Islands, Mackinac Island, Bois Blanc Island and Drummond Island. The 34 Les Cheneaux Islands extend along the north shore of Lake Huron midway between the Straits and the St. Marys River. Drummond Island at the eastern tip of the Upper Peninsula supports a permanent population as well as numerous summer homes and cottages. A dolomite quarry on Drummond Island is the major source of island employment.

Mackinac Island, situated east of the Mackinac Bridge, has played a strategic role in American history as a mission, trading post and military fortress. The island has been restored to its original condition and is now one of the most popular tourist attractions in the midwest.

### *Region 12*

Marquette, Alger, Schoolcraft, Delta and Menominee counties are the five coastal counties of the central Upper Peninsula region. Lakes bounding the region are Lake Superior and Lake Michigan. The principal urban shoreland communities are Manistique, Escanaba, Gladstone, Menominee, Marquette and Munising.

Portions of the shoreline in the region are characterized by high bluffs which possess outstanding aesthetic beauty. Rock outcrops in the vicinity of Seul Choix Pointe and rock bluffs along the Garden Peninsula are especially scenic. The eastern portion of the region is generally underlain by sedimentary rocks as evidenced by the Cambrian sandstones of the Pictured Rocks near Munising.

Extensive sand beaches can be found near the mouth of the Huron River in Marquette County, along a 13-mile reach east of Marquette and along a 12-mile stretch in the Pictured Rocks area. The towering Grand Sable Dunes extend for five miles to the west of Grand Marais and are the largest dune formations in the Upper Peninsula. The marsh shore of Big and Little Bays de Noc provide excellent fish and wildlife habitat and are heavily used for fishing and hunting.

### *Region 13*

The coastal counties of Gogebic, Ontonagon, Houghton, Keweenaw and Baraga encompass the coastal areas of the western Upper Peninsula. The region's shoreland terrain is quite varied, including flat lake plains, steep sloped areas, igneous and sedimentary bedrock. The shoreline is further characterized by rugged, rocky bluffs and sand beaches, and a collection of outcroppings along the tip of the Keweenaw Peninsula.

Isle Royale, situated 48 miles northwest of the Keweenaw Peninsula in Lake Superior, is one of the nation's most unique national parks. It is a living museum of northern animals and forest bounded by rocky coasts.

### **Region 14**

The west Michigan shoreline region includes Oceana, Muskegon and Ottawa counties. The shoreline in the region is characterized by sand dunes — some towering to great heights over Lake Michigan. The large dunes at Silver Lake are a special scenic and recreational attraction.

Oceana, Muskegon and Ottawa counties were at one time rich in timber, consisting largely of white pines. Thus, much early development was located around the dune impounded lakes and the mouths of rivers — the focus of lumbering activities. The lumber industry eventually dissolved, but the markets which the counties supplied timber remained, and thus were available for the trade of other commodities. Today, major development in the region is centered around these river mouths and lakes, particularly Muskegon Lake, and the mouth of the Grand River at Grand Haven.

### **Coastal Character — Shoreline Ownership**

Figure II-B illustrates ownership characteristics for the Great Lakes and connecting waterways. Ownership of the Great Lakes coastal area varies, although not to the extent that use and development vary. Great Lakes bottomlands are held in public trust. The majority of coastal land areas are in private ownership.

### **Coastal Character — Use and Development**

As shown in Figure II-C., Michigan's coastal use and development differs greatly. *Lake Superior's* 666 miles of shoreland are the most rugged, undeveloped, and inaccessible of all the Great lakes, yet support valuable mining and tourist industries. While recreation facilities are an important development along the Lake Superior shoreline, residential housing remains the most common type of shoreland development. The St. Marys River — a major highway for water-borne traffic — is the connecting waterway between Lake Superior and Lake Huron. Important to this area is commercial and industrial development adjacent to the famous Soo Locks at Sault Ste. Marie.

The 845 miles of *Lake Michigan* shoreline are characterized by heavy residential development in the southern end of the Lower Peninsula and some seasonal housing development in the northern Lower Peninsula and Upper Peninsula. Seventeen state parks with over 47 miles of shoreline, state and national forests, 33 commercial and recreational harbors, and numerous public access sites accommodate intensive recreational use of the lake. Commercial and industrial development is limited directly on Lake Michigan, but is important to communities surrounding coastal lakes such as Muskegon, Manistee and Ludington. More than 165 miles of island shoreland

contribute greatly to the historic, cultural and environmental significance of the Lake Michigan shoreline.

Nearly 50 percent of *Lake Huron's* coast is in forest land, agricultural or undeveloped use. The other predominant type of use is residential development along the lake's 634 miles of coast. Certain shoreland areas, such as those found along Saginaw Bay, Potagannissing Bay, Munuscong Lake and many islands, comprise more than 345 miles of shoreline that are valuable to the preservation of Great Lakes fish and wildlife species.

*Lakes Erie, St. Clair and the St. Clair and Detroit Rivers* are bordered by 147 miles of highly developed shoreline. Urban-industrial complexes centering in this area have decreased the amount of remaining agricultural and undeveloped lands. Much in demand are recreational facilities which, to date, occupy less than five percent of the shore. Marshlands located along Lake Erie at the mouth of the St. Clair River, and Dickinson and Harsens Island are congregation points for migratory waterfowl.

### **Coastal Character — Geomorphic Shore Types**

Important to the use and development of coastal areas is the unique mix of shore types found on each of the Great Lakes. Clay bluffs and sand beaches and some of the largest sand dunes in the world border Lake Michigan. The incredible beauty of Lake Superior is enhanced by towering rock bluffs, sandstone cliffs and sand beaches. In contrast, the Lake Huron coast is characterized by wetlands and rock beaches, while shoreline alterations along Lakes Erie and St. Clair and the Detroit and St. Clair Rivers characterize the largely flat and low coastal plain of southeast Michigan.

Diverse shore types contribute to the unique quality of the Great Lakes coast. The following shore types can be used to describe Michigan's coast: erodible bluff; nonerodible bluffs; sand dunes; low plains and wetlands.

#### ***Erodible Bluffs***

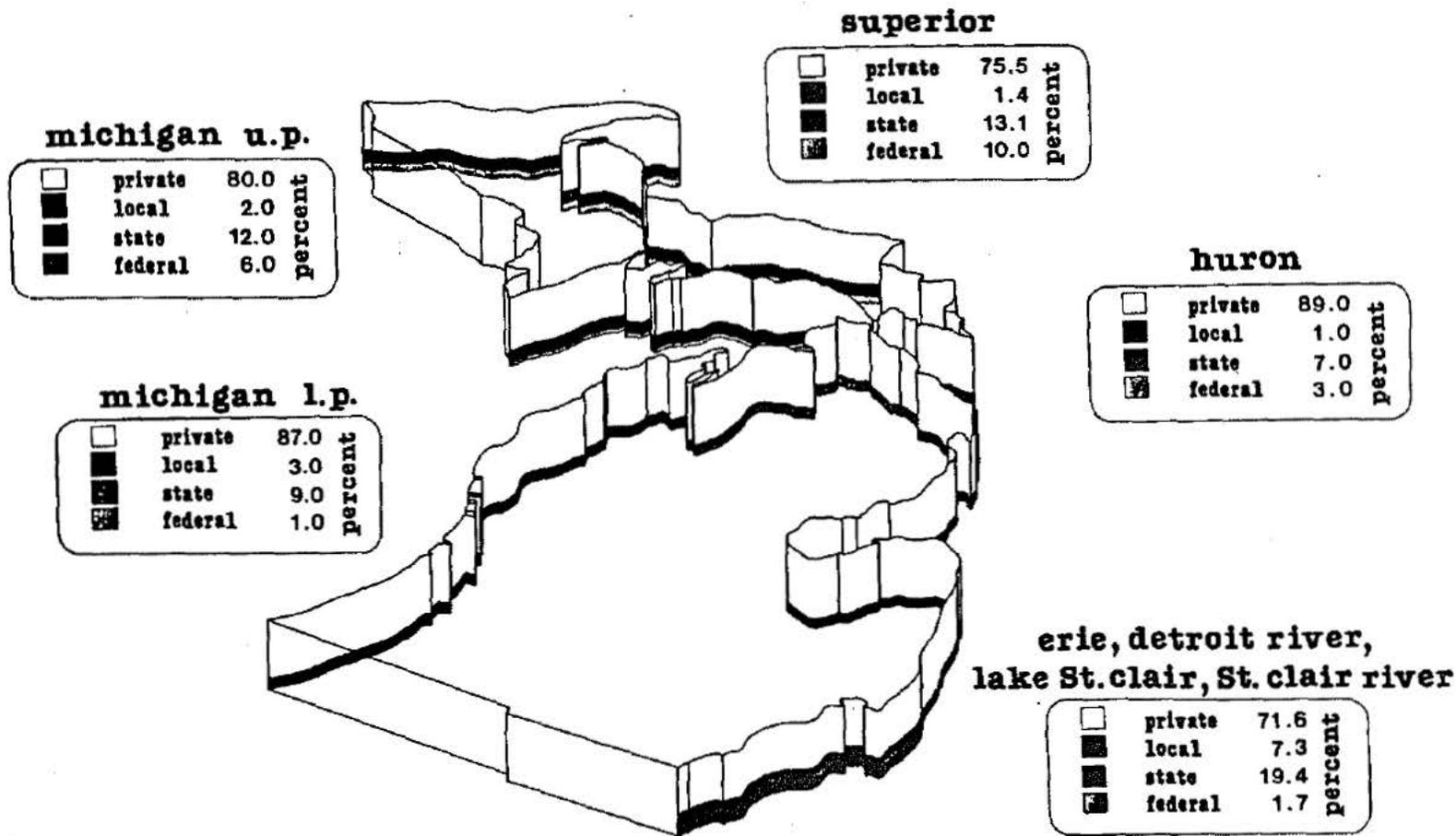
Erodible bluffs comprise 26 percent of Michigan's shoreline. Bluffs are composed of unconsolidated materials, such as sand and gravel, that are highly unstable under wave attack. Along the Great lakes, erodible bluffs range in height from 10 to 300 feet, and in steepness from about 20 degrees to nearly 90 degrees. Due to frequent erosion caused by waves, runoff and wind, the bluff face is usually devegetated, prone to failure, and consequently these areas pose severe hazards for most land uses.

#### ***Nonerodible Bluffs***

Nonerodible bluffs, by contrast, are extremely stable because they are usually composed of bedrock or rock rubble. This shoreland type is generally steeper than the erodible bluffs, exhibiting a sea cliff form in many places. In addition, the bluff face is usually barren of vegetation. Because of their rocky composition, nonerodible bluffs are the most stable shoreline in the Great Lakes, and, as a whole, the least problematic for residential development. Nonerodible bluffs are found along 13

# Michigan's Mainland Great Lakes Coast

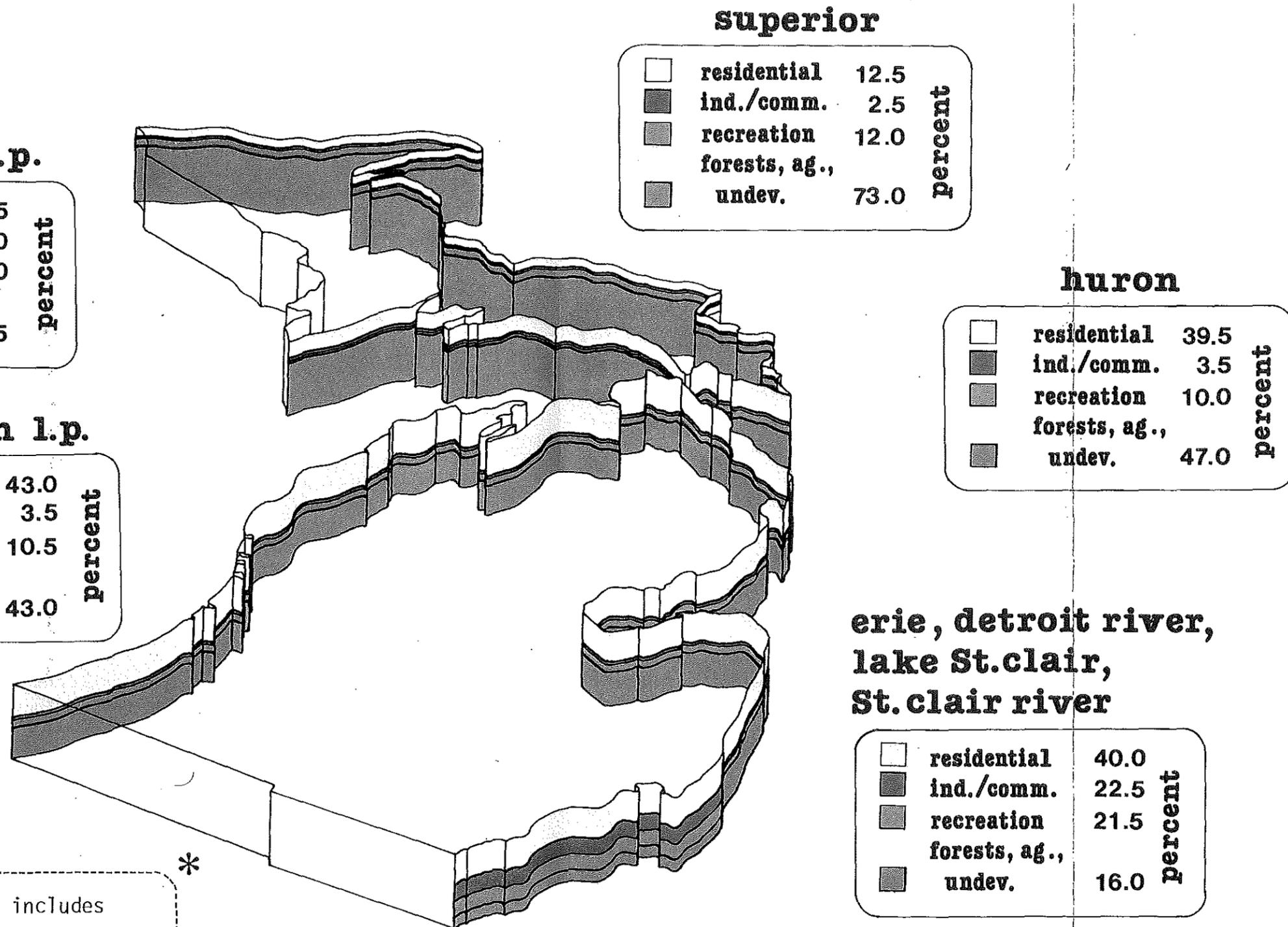
## FIG. II-B



Ownership

# Michigan's Mainland Great Lakes Coast\*

## FIG. II-C



\*  
Industrial and Commercial includes  
Public Service Facilities  
  
Recreation includes wildlife preserves

percent of the Michigan coast — mostly in the Upper Peninsula.

### *Low Plains*

Low plains are the most common shoreland type, comprising 33 percent of the Michigan shoreline. They are distinguished primarily by relatively low elevations only a few feet above lake level, and flat or gently rolling topography. Low plains may be composed of clay, loose sand, bedrock or manmade landfills. They may, therefore, be described according to their variable erodibility, drainage capacity, and suitability for development as either erodible (sandy, clay, etc.) low plains, nonerodible (rocky) low plains, or manmade low plains such as landfills.

### *Wetlands*

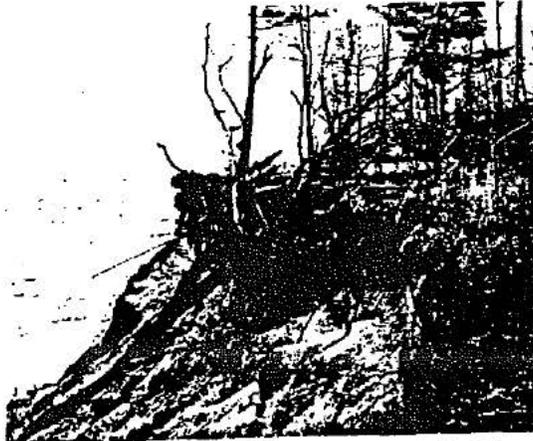
Wetlands are those areas where the water table is at, near or above the land surface for a significant part of most years. The water regime is such that aquatic or hydrophytic vegetation is usually established, although flood plains and some low-lying shoreline areas can be nonvegetated. Wetlands are frequently associated with topographic lows, even in hilly regions. Examples of wetlands include marshes, mud flats, wooded swamps, and floating vegetation situated on the shallow margins of bays, lakes, rivers, ponds, streams and manmade impoundments such as reservoirs. They include wet meadows or perched bogs in hilly areas and seasonally wet or flooded basins or potholes with no surface water outflow.

A Wetlands Value Study, recently conducted by the Coastal Management Program, provided important confirmation about the significant ecological functions and economic values of coastal wetlands. Study results revealed that about 21 percent of the waterfowl harvest, 14 percent of the duck production, 11 percent of the muskrat take, 15 percent of the commercial fish landings, and a large proportion of the sport fishing occurs in coastal wetlands or adjacent shallow waters. A 1972 inventory showed that Michigan has 105,855 acres of coastal wetlands — about 3.5 percent of the state's total wetland acreage. The Wetlands Value Study summarized that coastal wetlands contribute an estimated \$489.69 per wetland acre/year, for a total of \$51.8 million yearly. This value was derived from analysis of sport fishing, nonconsumptive recreation, waterfowl hunting, trapping of furbearers and commercial fishing uses. Phase II of the study, yet to be conducted, will examine hydrological, chemical and geological characteristics and the primary productivity of coastal wetlands.

### *Sand Dunes*

Sand dunes are unstable, windblown formations which lie inland from the shore. In places, dunes may extend inland several hundred yards and reach heights of 400 feet above lake elevations. Usually they are well drained and partially covered by grasses, shrubs and small trees. Due to their attractiveness as building sites, sand dunes are highly prone to development. Dunes also serve as a local catchment source of precipitation and ground-water recharge. As development takes place, dune

## GEOMORPHIC SHORE TYPES OF MICHIGAN'S COASTAL AREA



Erodible bluffs are prone to erosion and pose severe development hazards



Nonerodible bluffs are extremely stable and are found primarily along the Upper Peninsula shoreline



Low plains are the most common coastal shoretype



Coastal wetlands provide for maintenance of fish and wildlife populations



Coastal sand dunes are valuable resources for their scenic, recreational and economic qualities

formations and their erosion or deposition activities are often disrupted. Dunes are found along over 12 percent of the Michigan coastline.

## **GEOGRAPHIC EXTENT OF MICHIGAN'S COASTAL BOUNDARY**

Nearly all of Michigan has some coastal interest or dependence. Only a much smaller area, however, has a strictly coastal character. Defining the limits of that coastal boundary describes the lands and waters eligible for Coastal Management Program financial and technical assistance, and the geographic area in which specific regulatory authorities will be enforced to control uses or activities which may have an adverse impact on coastal resources.

Although establishing a coastal boundary is an administrative necessity of the Coastal Management Program, it must also be accomplished within the perceptions of what the coast means to Michigan citizens — in terms of its character, problems, issues or opportunities. The boundary must be easily understood and identified on maps and on the ground.

The Coastal Management Program defines the coastal boundary in terms of lakeward and landward limits, using the ordinary high water mark of the Great Lakes to define the land-lake interface. Lakeward areas of the coastal boundary are easily visualized but the landward boundary involves more complex considerations.

### **Lakeward Coastal Boundary**

By federal definition, the lakeward coastal area must include all submerged lands, waters and islands of the Great Lakes and connecting waterways, (Keweenaw Waterway, St. Mary's River, Lake St. Clair, St. Clair River and Detroit River), to the state or international boundary in the middle of the lakes. This boundary includes, in their entirety, islands and transitional areas (such as coastal wetlands) lying lakeward of the ordinary high water mark.\* Thus, the lakeward coastal boundary is the jurisdictional border Michigan shares with Canada's Province of Ontario and the states of Minnesota, Wisconsin, Illinois, Indiana and Ohio, (see Figure II-D).

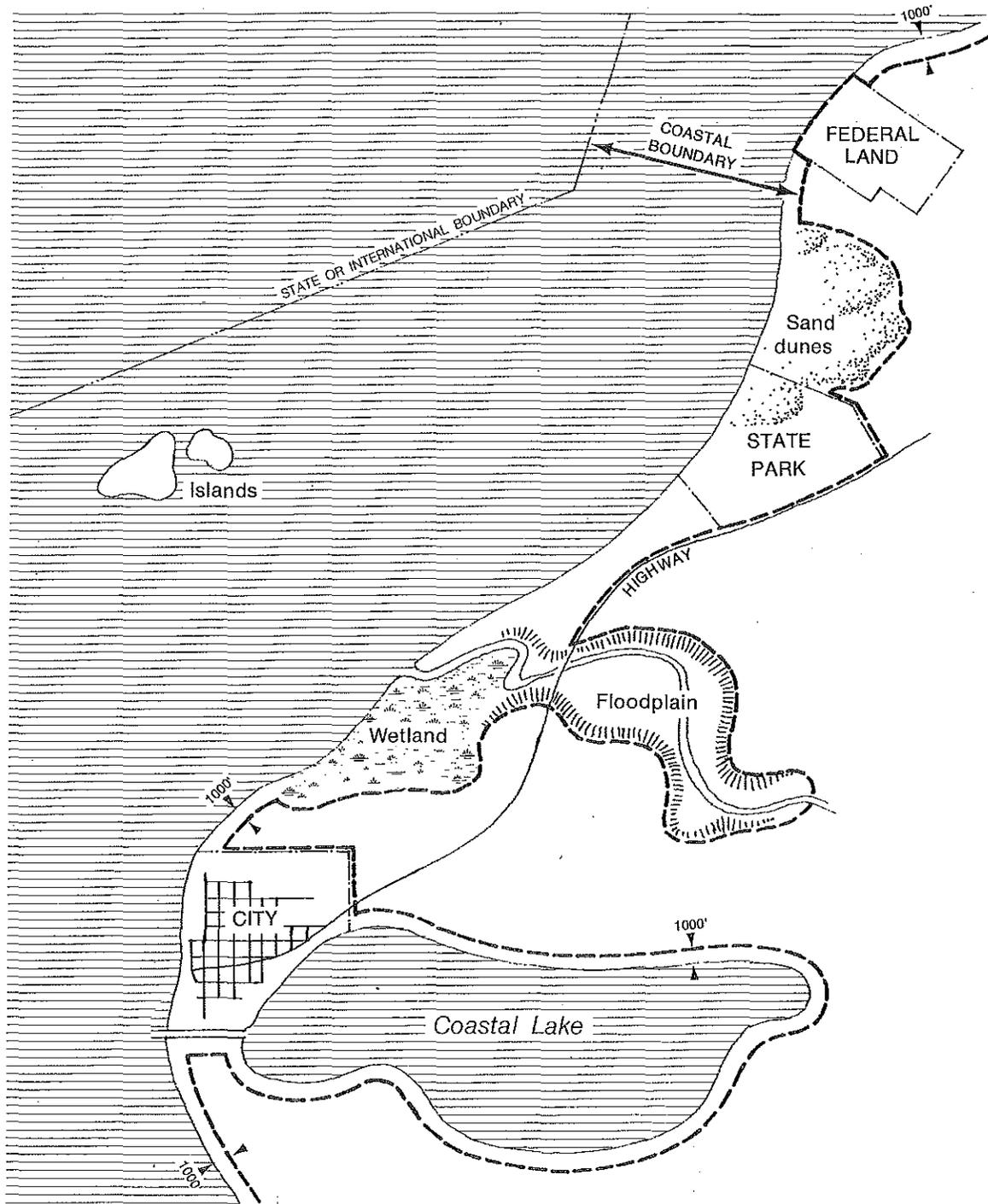
---

\*The ordinary high water mark is established by Act No. 247 of the Public Acts of 1955, as amended. The ordinary high water mark means the line between upland and bottomland which persists through successive changes in water levels, and below which the presence and action of the water is so common or recurrent as to mark upon the soil a character, distinct from that which occurs on the upland, as to the soil itself, the configuration of the surface of the soil and vegetation. The ordinary high water mark shall be deemed at the following elevations above sea level, international Great Lakes datum of 1955:

On Lake Superior it is 601.5 feet, on Lakes Michigan-Huron it is 579.8 feet, on Lake St. Clair it is 574.7 feet, and on Lake Erie it is 571.6 feet.

The ordinary high water mark of inland waters is determined under the authority of the Inland Lakes and Streams Act, Act No. 346 of the Public Acts of 1972, as amended. Elevations for connecting waters linking the Great Lakes are interpolated from established ordinary high water marks for the adjoining lands. Actual location of the ordinary high water mark for the Great Lakes and connecting waterways is determined by field survey.

FIG. II-D  
Schematic Diagram of the  
Michigan Coastal Management  
Program Boundary



## Landward Coastal Boundary

The landward coastal area extends inland to encompass resources and resource using activities which influence or are influenced by the coastal area in both a direct and significant fashion. These resources and activities involve lands which have a demonstrable interaction with coastal waters in physical, biological, chemical, thermal or other terms. Analysis of these relationships indicates the Michigan's landward coastal boundary includes: (1) lands abutting the ordinary high water mark of Great Lakes and their connecting waterways; (2) lands abutting other water bodies which are directly affected by water levels of the Great Lakes and their connecting waters such as floodplains or inland lakes; (3) transitional areas landward of the ordinary high water mark such as sand dunes, wetlands, etc.; and (4) other lands which are sensitive to intense use pressure related to coastal waters such as recreation areas, urban areas, etc.

Several alternatives were considered by the Coastal Management Program in delineating the landward boundary. One alternative approach might have been based on political borders, encompassing whole cities, townships, etc. Although this option could have some administrative advantages, it was deemed more efficient to focus attention on territory, needs and problems of truly coastal character. Using natural features such as watershed boundaries or cultural features such as service areas for water supply or wastewater treatment encompassed virtually all of the state and was considered impractical.

A compromise solution was selected from mandates contained in one of the most definitive descriptions of land-lake interactions and the resultant boundary in state legislation — Michigan's Shorelands Protection and Management Act (Act No. 245 of the Public Acts of 1970, as amended). This Act and other state statutes, such as the Great Lakes Submerged Lands Act, Inland Lakes and Streams Act, and the Sand Dunes Protection and Management Act use the state-legislated ordinary high water mark as the definition of Michigan's Great Lakes shoreline. Landward from that line, Act No. 245, for example, considers certain coastal areas of statewide concern in terms of their resources and impacts of resource-using activities. Geographically, however, Act No. 245's authority is limited to a maximum of 1,000 feet landward from the ordinary high water mark.

Though the area affected by Act No. 245, and the other acts referred to above, is too limited to satisfy the boundary requirements of the Coastal Management Program, their boundary concepts provides a valuable precedent.

Michigan's Coastal Management Program accordingly adapted a similar approach which delineates an inland boundary extending in most cases a minimum of 1,000 feet from the ordinary high water mark. The boundary also has inland extensions or bulges around areas containing resources or uses which have a physical, chemical, biological or other demonstrable impact upon the Great Lakes. Areas which are included by extending the boundary further inland from that baseline include the following coastal areas as illustrated in Figure II-D and described in the following text. To provide for ease of identification, the coastal boundary is often simplified on maps and on the ground using physical or cultural features, which approximate the 1,000 foot distance from the ordinary high water mark. Thus, the coastal boundary adopts such recognizable features as roadways, section lines, electrical power lines, political

boundaries, rail lines where such features provide reasonable approximation for meeting boundary criteria.

- Coastal lakes, river mouths and bays
- Floodplains
- Wetlands
- Great Lakes sand dune areas
- Public park, recreation and natural areas
- Urban areas

### *Coastal Lakes*

Chemical, biological and hydrologic properties diffuse freely throughout a lake. Such interchange may also take place between a Great Lake and a coastal lake, particularly where they are connected by a channel. Coastal lakes are also affected by uses of their shores, (e.g., industrial plants, marinas, etc.). The influence of the Great Lake on a coastal lake may be minimized where the coastal lake is impounded above its natural level.

Thus, the coastal boundary includes in its entirety any lake within 1,000 feet of the shore of a Great Lake or connecting waterbody. In addition to the entire coastal lake, a minimum 1,000-foot buffer around the lake is included to account for effects of shore uses. Lakes further inland which are connected by channels to a Great Lake or connecting water body are treated as river mouth areas.

### *Coastal River Mouths*

There are important relationships between tributary mouths and Great Lakes waters. Free flow of water from one to the other results in sharing of chemical and biological properties. Stream flow from tributaries replenishes the Great Lakes, and river mouth areas are subject to flooding from high Great Lakes water levels. Lake freighters dock and load at sheltered and convenient river mouth locations. Similarly, river mouths provide desirable locations for Great Lakes pleasure craft marinas. Anadromous Great Lakes fish travel far upstream to spawn. However, extending the coastal area too far upstream may include an unreasonable amount of territory which would dilute the coastal focus of this program.

For the purpose of coastal boundary delineation, tributary river mouths are treated as coastal water in the same manner as open coast. There is a landward boundary consisting of a 1,000-foot strip on both sides of the tributary. These 1,000-foot strips are enlarged by bulges for uses and resources which have a demonstrable land-lake interaction. The inland point to which the coastal boundary extends up a tributary is: (1) the point at which the tributary bed's elevation is higher than the nearest Great Lakes 100-year flood level; or (2) the upstream limit to which the U.S. Army Corp of Engineers maintains a deep draft navigation channel, whichever is further inland.

## *Flood Plains*

Areas subject to flooding from Great Lakes influences deserve consideration in coastal management. Surveyed contours are a stable and logical tool for identifying such lands and have been mapped for almost the entire Michigan coast. The Corps of Engineers' report on Great Lakes Open-Coast Flood Levels, (1977, termed Phase I of the two phase study), identifies 10-year, 50-year, 100-year, and 500-year flood elevations for open coast on Lakes Superior, Michigan, Huron, Erie and St. Clair. These calculated elevations have not been made for bays (including Saginaw Bay), other inlets, coastal lakes, or the Great Lakes connecting streams.

Thus, the 1,000-foot strip landward boundary is extended to encompass areas adjacent to the shore and bounded by the U.S. Geological Survey contour line which is: (1) closest to the 100-year flood elevation, (depending upon contour intervals which vary, depending upon the map available for boundary delineation), established for the nearest reach of Great Lake; or (2) encompassed in existing FIA flood hazard maps or Flood Insurance Rate Maps prepared by Federal Insurance Administration, (not including rough maps printed for review purposes without dates).

For all bays and inlets in which the 100-year flood elevations has not been determined, the contour level established as the 100-year flood elevation is used to develop the boundary. Floodplain estimates of the Great Lakes connecting waterways are based on elevations derived under Phase II of the Corps of Engineers studies. The boundary in these areas may be extended landward in areas where communities have elected to develop local floodplain zoning ordinances, in anticipation of the Federal Flood Insurance Administration guidelines, in lieu of elevations derived under Phase II of the Corps study.

## *Wetlands*

Coastal wetlands are important transitional areas with special biological and hydrologic value. Many have been destroyed by urban development and others are similarly threatened. The location and extent of the state's coastal wetlands vary with Great Lakes water levels. A coastal floodplain, based on geologic contours, is a fairly stable measurement which correlates with characteristics which create wetlands.

Therefore, the 100-year floodplain is used as an approximation of the area where coastal influences create wetlands. In addition, areas beginning within 1,000 feet of the Great Lakes ordinary high water mark, which have been identified by airphotos or otherwise as being wetlands over extended periods of time are also included in the boundary in their entirety.

## *Great Lakes Sand Dunes*

Dunes have scientific and scenic value, and their sands are valuable to industry. Dunes are fragile and unstable if vegetative cover is disturbed. Some support unusual vegetation types. Dune formations may extend as much as a mile or more inland. Vegetated dunes are difficult to identify from air-photos, and inland sand hills may

require inspection to determine whether they consist of wind-and-water-processed dune sand or not. The state has proposed delineations of dunes according to mandates of Act No. 222 of the Public Acts of 1976 for the first seven areas to be designated under this Act.

The coastal boundary incorporates designated sand dune formations in their entirety to the extent they have been identified.

The coastal boundary will be refined in the future to incorporate additional designated sand dune areas in administering the state's Sand Dune Protection and Management Act. Since the coastal boundary will include entire dune formations, no buffer zone is added.

### ***Public Park, Recreation and Natural Areas***

The Coastal Management Program will seek to improve the wise use of recreational areas and the protection of coastal natural areas. The degree of use and development fostered in such public open areas partly determines whether recreation will have any destructive impacts on the coastal environment, although some recreational areas may contain portions so far inland that coastal relationships are minimal.

The coastal boundary, therefore, includes, in their entirety, publicly owned park, recreation or other natural areas which fall anywhere within 1,000 feet of the ordinary high water mark which have been designated by a public agency and administered for the preservation of natural values.

### ***Urban areas***

Some coastal activities and some effects on coastal waters depend, directly or indirectly, on activities and conditions elsewhere in an urban area. The original terrain in some urban areas may have been altered by leveling and filling to the point where true contours and hence floodplains are not discernible. Uses of heavily built-up land are fairly well fixed and less easily influenced by coastal management actions than other lands.

For *moderately urbanized* areas — where the first 1,000 feet of shore may contain a mixture of urban uses and undeveloped land — the basic 1,000-foot strip, augmented by extensions for features defined above, is retained. For *heavily urbanized* areas, the boundary is, in most cases, the first major roadway along the shore, with the provisions that: (1) river mouths are treated as coastal waters; (2) publicly owned and administered parks, recreation areas and natural areas within 1,000 feet of the shore are included within the coastal boundary in their entirety; and (3) where the Federal Insurance Administration has identified a 100-year floodplain beginning within 1,000 feet of the ordinary high water mark, the coastal boundary is extended landward to include the entire floodplain; and (4) areas designated pursuant to Act No. 245 of the Public Acts of 1970, as amended, the Shorelands Protection and Management Act are included in the boundary, (Act No. 245's authority extends 1,000 feet from the ordinary high water mark).

## **Other Boundary Delineation Considerations**

### *Excluded Lands*

All lands owned, leased, held in trust or otherwise legally subject to the sole discretion of federal agencies in their use are specifically excluded from the state Coastal Management Program boundary by the federal Coastal Zone Management Act. Although federally owned lands are excluded from the boundary, federal activities on these lands must be shown to be consistent "to the maximum extent practicable" with the Coastal Management Program (as described further in Chapter VI). An inventory of federally owned lands has been conducted. An ongoing process to assure accurate identification of these lands will continue. A description of these lands is contained in Appendix A of "State of Michigan Coastal Management Program and Draft Environmental Impact Statement".

Indian trust lands are eligible for assistance as regional entities although such lands are excluded from the boundary.

Private inholdings which are presently located in such areas as national forests and lakeshores have been identified from analysis of plat books and will be included in the coastal boundary and are subject to policies of the Coastal Management Program. As additional lands are acquired by federal agencies as national forests, lakeshores, etc., these federally owned lands will be excluded from the boundary. In addition, many of these inholdings are subject to specific requirements established by federal agencies which administer the adjacent federally owned lands.

### *Interstate Coordination*

To avoid conflicts with coastal boundaries defined by neighboring states' coastal management programs, this program will employ ongoing interstate coordination efforts (most notably through the Great Lakes Basin Commission) in making its boundaries conceptually and cartographically compatible with other states' efforts.

### *Boundary Revisions*

The coastal boundary may be revised as necessary based upon criteria which include: (1) additional sand dune areas as designated under the Sand Dune Protection and Management Act (Act No. 222 of the Public Acts of 1976); (2) floodplain elevation contours as completed; (3) additional public recreation, park or natural areas as established; (4) existing or future state legislation or revised regulations issued pursuant to existing legislation which identifies areas with a strong relationship to the coast which merit special management attention; (5) areas of particular concern as nominated which demonstrate land-lake relationships for such areas as scenic access, etc.; and (6) other areas as their relationship to coastal impacts or resources becomes more evident, (e.g., extent of tributary pollution loadings). In cases where boundary is revised, the Office of Coastal Zone Management will determine if the revision is an amendment or a refinement to the program.

### *Availability of Boundary Maps*

Michigan's ten coastal planning and development regional agencies provided draft boundary maps which have been finalized by the state to insure that boundary lines at regional agency borders are compatible and to incorporate recently designated sand dune areas, (designated under Act No. 222 of the Public Acts of 1976). This mapping effort consists of over 230 separate quadrangles, primarily at 7½ or 15 minute topographic scales. Due to the poor reproductive capability of many maps and the high degree of variability in existing map scales, it is, at present, extremely time consuming and costly to provide a reproducible set of boundary maps. Individuals of agencies may, however, consult coastal boundary maps at either the office of the Coastal Management Program, 7th floor, Stevens T. Mason Building, Lansing, Michigan; or at the office of coastal regional planning and development agencies. Xerox copies of coastal boundary maps may currently be provided by the Coastal Management Program at a cost which will vary according to the number of maps requested and the size of the map(s) which must be reproduced.

In an attempt to assess the usefulness of other mapping documents, the Coastal Management Program conducted a demonstration project with the Michigan Department of State Highways and Transportation to identify land use/land cover and the coastal boundary for 23 Michigan ports. In the near future, a second demonstration project will map land use cover and the coastal boundary for the coastline from Manistique to Escanaba, along the northern Lake Michigan shore. As a result of this activity, computer reproductions of both land use/land cover and the boundary will be available for the pilot areas at virtually any map scale requested. During implementation, this program will determine the feasibility of expanding this project statewide along the coast.

### *Boundary Field Inspection*

If it should become necessary to ascertain whether or not certain land areas are located in the coastal boundary, field checks will be made within two to three weeks of the request by either the Department of Natural Resources or participating planning and development regional agencies.

## **SUMMARY**

Michigan's coastal character is varied with magnificent resources, worthy of protection and management. The coastal boundary provides a focus for Coastal Management Program implementation activities to protect coastal resources and solve coastal problems.