GIS-BASED SHORELINE RECESSION ANALYSIS ON THE EASTERN SHORE OF LAKE MICHIGAN

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Shoreline recession is becoming an increasingly important environmental issue in the United States as a growing population taxes limited resources, both on open ocean coasts and in the Great Lakes (Williams et al., 1991; Raphael and Kureth, 1988). Shoreline recession occurs as a result of complex interactions between physical processes and geologic materials. For example, factors such as wave and current energy (Davis, 1976; Hands, 1979, 1980), near- and onshore lithology (Nairn, 1992; Boyd, 1992; Gelinas and Quigley, 1973; Edil and Vallejo, 1977), and groundwater head (Sterrett, 1980; Montgomery et al.,1996) have been found to be influential in the development of spatial and temporal recession patterns that occur on glaciated coastlines in the Great Lakes.

An integrated study of bluff recession, bluff lithology, and groundwater head was performed during the mid-1990s (Montgomery, 1998) under the sponsorship of the U.S. Army Research Office (ARO) along a 10-mile stretch of the eastern Lake Michigan shoreline in heterogeneous Pleistocene deposits. Techniques that were utilized in the study included: analysis and mapping of previously under-utilized, public domain subsurface water well data (Montgomery et al., 1996); determination of geotechnical properties (Montgomery et al., 1997); and slope failure modeling (Montgomery et al., 1998) and monitoring (Chase et al., 1997).

Geographic Information Systems (GIS) technology lends itself to the mapping and study of multiple factors, and has proved to be a useful tool in the study of shoreline recession (Law et al., 1991). In the eastern Lake Michigan study area, GIS was used in both the characterization and mapping of bluff lithology and hydrology (Montgomery et al., 1996) and in the analysis of historical recession patterns (Montgomery et al., 1997,1998). Bluffs in the study area can be characterized lithologically as sand, clay, or mixed sand/clay, and can be characterized hydrologically as exhibiting either high head or low head. Mixed sand/clay bluffs with high hydraulic head were found to have receded up to 100 feet (30.0 m) over the long term (1938 to 1996), whereas bluffs characterized as all clay or all sand receded 50 feet or less (15.0 m) during this period. Over the short term (1989 to 1996), a period in which Lake Michigan water levels were not unusually high, mixed sand/clay bluffs were the only ones in the study area to show measurable (> 4 feet, 1.2 m) retreat.

The litho- and hydrostratigraphy of Long Island, especially the North Shore (Anders, 1998, pers. commun.; Nairn, 1998, pers. commun.) may be comparable to that of the eastern shore of Lake Michigan. Presumably, subsurface data from

water wells is also available. If this is the case, the techniques developed and successfully applied on the eastern shore of Lake Michigan may be effective in the study of shoreline recession on Long Island as well.

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