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## EROSION CAUSED BY ICE

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## ABSTRACT

*The purpose of this study was to evaluate the documented and potential importance of ice erosion along reservoir banks. The evaluation is based on a literature review and on inferences drawn from field observations and experience. Very little is known about the amount of reservoir bank erosion caused by ice action, although considerable information exists on ice erosion processes along the shorelines and beaches of oceans, rivers and lakes. The importance of ice-related erosion along a reservoir bank would depend primarily on water level, but ice conditions and bank sediment characteristics would also be important. If the reservoir water level is at bank level, ice could directly erode a bank face. If the water is below the bank, ice would have no direct effect on it. However, ice could indirectly increase bank instability by disrupting and eroding nearshore and beach zones, which could lead to bank erosion.*

## INTRODUCTION

Reservoirs are in a special category of inland water bodies, and they differ from natural lakes in two ways: their construction disturbs existing natural conditions by reforming shorelines and riverbeds, and their water level is usually controlled by man (Doe, 1980). Reservoirs typically have one or more of the following functions: water supply, irrigation, flood control, navigation, hydropower generation, recreation, and development and expansion of plant and animal habitats (Hagan and Roberts, 1972; Hodgins et al., 1977), although flood control is usually their primary purpose. Since water level controls the water-

holding capacity of flood control reservoirs, the water level is changed according to annual flood control requirements, which are dictated by precipitation and runoff.

In the northern U.S., water levels on flood control reservoirs are usually lowered during the late fall and winter and kept at a minimum in preparation for high spring runoff. The levels rise in the spring because of frequent storms and snow melt and because the amount of water released from a reservoir at this time is low to reduce or eliminate downstream flooding. Water levels are maintained at their highest during the summer and early fall as water is stored or slowly released for other purposes. Superimposed on these large annual fluctuations are the small water level changes caused by daily operations and by those operations required to fulfill other reservoir functions.

Bank erosion occurs in many reservoirs and reduces their usefulness. The causes of, and factors contributing to, bank erosion and the complexity of their interrelationships have been described (Lawson, 1983, 1984; Pincus, 1962; Seibel, 1972; Simons et al., 1978, 1979; Sterrett, 1980), but the relative importance of the factors and processes has not been determined. This study focuses on bank erosion caused just by reservoir ice and was done as part of an on-going investigation to measure and determine some of the erosion processes and factors that are important in cold regions. It is based on a literature review and on field observations made by colleagues and myself.

Most of the literature dealt with ice erosion processes along ocean, river and lake shorelines and beaches. I did not find any references that addressed ice erosion along reservoir banks. However, since