



US Army Corps
of Engineers
Omaha District

Sedimentation Impacts in the Cheyenne River Arm – Lake Oahe

Phase II, Projected to 2058

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EXECUTIVE SUMMARY

The Cheyenne River flows into Lake Oahe approximately forty miles upstream of Oahe Dam. The Cheyenne River basin comprises approximately 26,000 square miles, on the west side of the Missouri River, in west central South Dakota. Oahe Dam was completed in August 1958, and initially reached its minimum operating pool in April 1962.

Water discharge data for the Cheyenne River were obtained from stream gage records for 1929 through 1994. Survey ranges are in place to monitor the lake's effect on the river. Hydrographic surveys have been conducted at these ranges approximately every five years. Available data on sediment discharge was used to estimate the relationship between bed material load and water discharge for the full range of flows in the hydraulic model.

The HEC-6 computer package produced estimates of sedimentation, which were compared to surveyed sections across the Cheyenne River Arm. The bed material load function was adjusted until its results came closest to the elevations surveyed at the cross sections. The model's input for water temperature and lake pool elevation were assigned average values according to statistical correlation with flow ranges. Coefficients for the sediment transport function were determined through the calibration process, for the period of 1958 through 1989.

The HEC-6 model projected sedimentation rates for 50, 75 and 100 years of reservoir operation. These projections were initiated from the channel configuration of the most recent survey, 1989. The location of maximum total deposition moved from mile 31.5 in 1976 to mile 26.4 in 1989. The model shows that by the year 2058, the primary deposition will have moved further downstream, to mile 21.0. The total maximum depth of sediment is projected to reach 68 feet by the year 2058, at mile 21.0. The maximum rate of deposition from the present to 2058 (occurring at mile 21.0) is estimated at 0.6 foot per year.

The discharge having a 1 percent chance of exceedance was determined to be 127,000 cfs, based on the sixty-six years of stream gage records. The water surface elevation of a 1 percent chance flow would be over nineteen feet higher in 2058 than the same flow in 1958 (mile 36.3). In the area outside the pool's direct influence, the rise due to 100 years of sedimentation would be nine feet, in the reach between miles 40 and 43.5.

The extent of flood water coverage (for the 1 percent flood) resulting from 100 years of projected sedimentation in the Cheyenne River Arm was mapped relative to the project boundary of Lake Oahe. This yielded an estimated 550 acres that would be inundated laterally outside the existing boundary. Upstream of the current boundary, the 1 percent flood after 100 years of sedimentation would extend over an additional 383 acres (relative to the same flow in 1958).

The level of confidence for this study's results could be enhanced significantly if accurate bedload measurements are made for any future major high water events.