

Analysis and Design for Smith Irrigation Dam Rehabilitation Brighton, Colorado

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This project involved the completion of several dam safety related analyses in support of the new dam owner's rehabilitation of the reservoir/dam and his proposed development around the reservoir. The objectives of the project were:

1. Determine the current Hazard Classification of the dam;
2. Evaluate the capacity of the existing primary emergency spillway;
3. Compare the existing spillway capacity to the spillway size required by the OSE; and
4. If the existing spillway capacity did not meet the OSE requirements, determine the required spillway size and/or, at the direction of the dam owner, perform an Incremental Damage Analysis (IDA) to justify a smaller spillway requirement.

The National Weather Service's BREACH model was used to determine four key breach parameters: (1) the bottom elevation of the breach when it reaches its maximum size; (2) the bottom width of the breach at its maximum size; (3) the side slope of the breach; and (4) the time for the breach to reach its maximum size. The breach parameters were used in the HEC-1 model to develop and route the breach hydrograph. A hazard classification evaluation was performed to determine the potential consequences of the subject dam failure on residents and property below the dam and to identify the standards for the investigation, design, and construction of any improvements to the dam facility. The HEC-RAS model was utilized to determine and plot approximately 3 miles of inundation limits downstream of the Smith Irrigation Reservoir. Inundation limits were plotted on dam owner provided 2-foot contour interval topography as well as USGS 10-foot contour interval topography. Three major bridge and road crossings were located in the inundation zone.

An evaluation of the existing emergency spillway capacity was performed to determine if the spillway was large enough to satisfy Colorado Office of the State Engineer criteria. In support of the spillway evaluation, analyses were performed to determine the Probable Maximum Precipitation (PMP) and the resulting Probable Maximum Flood (PMF). The PMP and PMF analyses were performed using procedures found in Hydrometeorological Report No. 55a (HMR 55A) and the USBR's "Flood Hydrology Manual". The existing spillway was determined to not meet current OSE requirements; therefore an Incremental Damage Analysis was completed to justify an Inflow Design Flood (IDF) smaller than the required IDF. The IDA determined that the minimum IDF would still be larger than the existing spillway capacity. Therefore, improvements to the existing spillway were required.

ACE performed hydraulic evaluations and provided design input on all proposed emergency spillway improvements. Procedures and recommendations from USDA-NRCS Technical Release No. 52 "Design and Layout of Earth Emergency Spillway" and TR No. 60 "Earth Dams and Reservoirs" were utilized during the design of the earthen emergency spillway. All analysis and designs developed by Anderson Consulting Engineers, Inc. were submitted to and subsequently approved by the Colorado Office of the State Engineer.

