

## **A Review of Paleoflood Surveys in the Black Hills of Western South Dakota**

Nancy Steinberger, P.E., CFM  
Federal Emergency Management Agency, Lakewood, Colorado

Jeffrey D. Niemann, Ph.D.  
Department of Civil and Environmental Engineering, Colorado State University

**Abstract.** The US Geological Survey (USGS) and the South Dakota Department of Transportation (SDDOT) have recently completed a reconnaissance-level paleoflood study in the Black Hills of Western South Dakota (O'Connor and Driscoll, U.S. Geological Survey Project Report SD2005-12, 2007). Sediment from floods is transported through high velocity areas, but it is deposited in slackwater areas where the velocity is reduced. In sheltered alcoves, caves, and rock shelters, these deposits may be preserved for long periods of time. Over hundreds or thousands of years, successive floods may thus leave a sequence of deposits forming a stratigraphic record of large flow events. If organic material is entrained in the sediment layers, the approximate age of each deposit can be determined through radiocarbon dating techniques. Finally, the stage of each flood event can be estimated from the elevation of the depositional layers, allowing for the calculation of approximate discharges using hydraulic analysis techniques. Comprehensive paleoflood surveys and stratigraphic analyses were performed in four primary locations along a 1600 m (1 mile) reach of Spring Creek, and in two locations along a 1600 m (1 mile) reach of French Creek. The oldest flood deposit identified was dated at 400-200 B.C., with other floods identified in the periods A.D. 1024-1184, A.D. 1273-1391, and A.D. 1670-1680. The highest estimated paleoflood discharge was 92,000 cfs, compared to 50,000 cfs for a similar area during the 1972 extreme flood near Rapid City. The results of this work indicate that paleoflood techniques would lead to a better understanding of flood-frequencies for the Black Hills area, which will be investigated further in collaboration with the Federal Emergency Management Agency (FEMA). Potential directions for future research include expanding the paleoflood study to additional sites in the region, applying the Expected Moments Algorithm to obtain flood-frequency relations, investigating the use of mixed-population flood-frequency curves to address high outliers, and consideration of elevation and orographic influences on storm generation and intensity for extreme flood events in the Black Hills.