CHARACTERIZATION OF NATURALLY OCCURRING ACID ROCK DRAINAGE AND IMPACTS TO THE NORTH FORKS OF RAPID CREEK AND CASTLE CREEK NEAR ROCHFORD, SOUTH DAKOTA

Scott L. Miller and Arden Davis
Department of Geology and Geological Engineering

Scott Kenner and A.J. Silva
Department of Civil and Environmental Engineering
South Dakota School of Mines and Technology
Rapid City, SD 57701

ABSTRACT

Surface and ground water quality data have shown that naturally occurring acid rock drainage has negatively affected reaches of the north forks of Rapid Creek and Castle Creek in the Black Hills near Rochford, South Dakota. Field and laboratory data were collected in 2002 and 2003. The acid rock drainage samples had a pH of approximately 2.5 to 3.5 and contained high concentrations of iron, aluminum, and sulfate. Uncontaminated surface water had a pH of approximately 7 to 8.5 and contained high concentrations of calcium, magnesium, and carbonate. When the acid rock drainage mixed with uncontaminated water of the north forks of Rapid Creek and Castle Creek, natural buffering reactions occurred, increasing the acid rock drainage pH to above 7 and causing iron hydroxides and aluminum hydroxides to precipitate. Much of the metal hydroxide precipitate coated the stream bottom and cemented the sediments together. Some of the precipitate was transported downstream, negatively affecting the stream habitat for several hundred meters. Much of the plant and animal life in these areas was stressed, leaving some stream reaches devoid of all life. Natural chemical reactions caused the impacts to attenuate, restoring the stream’s habitat and water quality within approximately one to two km in the downstream direction.