LONG-TERM STABILITY OF DESIGNED EPHEMERAL CHANNELS AT RECLAIMED COAL MINES, WYOMING

May 25, 1993

Final Technical Report
for
Abandoned Coal Mine Lands
Research Program

Submitted By:

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ABSTRACT

Restoring the landscape to a stable configuration is central to the reclamation of abandoned coal mines in Wyoming. Reclamation efforts seek to reestablish long-term channel stability by efficiently routing surface water and sediment, while minimizing erosional processes. Evaluating the long-term performance and success of channel reclamation is a great challenge for government regulatory personnel because major channel adjustments typically occur in response to large, infrequent flood events. A risk-based channel stability analysis is presented to facilitate regulatory decisions and engineering design by statistically comparing reclaimed channel designs with natural analog areas. An inventory of reclaimed channel information was compiled for AML coal sites in Wyoming. Natural data for 17 basins adjacent to the Rainbow and Colony mines in south central Wyoming were collected in the field. For purposes of this study natural, undisturbed drainage basins adjacent to the mined areas are considered stable. Three channel parameters that are important channel design elements (channel slope, flow velocity, channel flow area) comprise separate long-term stability tests. One-tailed confidence intervals calculated about the mean predicted channel slope, flow velocity, and flow area from the natural data indicate that 18 out of 20 reclaimed channels at the Rainbow and Colony mines are stable at a risk level or alpha=0.1. Alpha is the risk associated with accepting a channel design that does not meet the stability test criteria. A more stringent stability test, alpha=0.01, indicates that 16 out of the 20 reclaimed channels are stable. Those channels that do not satisfy the stability test either have steeper channel slopes or smaller flow areas than the mean from adjacent natural channels, aspects that enhance erosion potential. User flexibility in choosing an acceptable alpha, and any combination of the three tests, allows modifications to suit the application. If channel reclamation truly intends to replicate a natural drainage system, then reclaimed channel designs should be judged based on geomorphic characteristics and relations established from natural areas.