STABILITY EVALUATION FOR DESIGNED EPHEMERAL CHANNELS IN WYOMING[1]

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Abstract: Evaluating the performance of reconstructed ephemeral channels at coal mine sites in Wyoming is a great challenge because major channel adjustments typically occur only in response to infrequent flood events. A risk-based channel stability analysis was developed by Western Water Consultants, Inc. (WWC, 1993) which allows statistical comparison between reclaimed channel designs and similar characteristics of unmined channels. unmined, natural stream channels can provide critical information about stable channel forms because the natural channel geometry has evolved over long time periods under prevailing climatic conditions. The 1993 research was limited to areas encompassing Abandoned Mine Land (AML) channel reclamation projects near Rock Springs and Hanna, Wyoming. three channel parameters that are important channel design elements (channel slope, flow velocity, cross sectional flow area) comprised separate stability tests. One-tailed confidence intervals calculated about the mean predicted channel slope, flow velocity, and flow area define the recommended range of acceptable channel designs. Designed channels at the AML sites that did not satisfy the stability test have either steeper channel slopes or smaller flow areas than the mean value for unmined channels.

In the current study (1994-1995), the stability evaluation will be extended to the active coal-mined regions of the state: eastern Wyoming (Powder River Basin), north of Glenrock, north of Hanna, northeast of Rock Springs, and west of Kemmerer. Stream channel and drainage basin information has been compiled for these five coal-bearing areas in Wyoming using mine permit application premining data, published reports, and field data. Additional parameters including sediment characteristics of the channel bed and banks will be included in this analysis to better understand how sediment influences channel stability. Results of the study will provide mine reclamation specialists and regulatory personnel with a quantitative method to evaluate reclaimed designs for ephemeral channels in the main coal-mined areas of Wyoming. Recommended channel design criteria which provide for stability will be presented.

Additional Key Words: Reclamation, geomorphology, channel design, channel stability, stability evaluation.

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ESSENTIAL HYDROLOGIC FUNCTIONS OF PLAYAS IN THE POWDER RIVER BASIN OF NORTHEASTERN WYOMING[1]

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Abstract: The Surface Mining Control and Reclamation Act of 1977 (SMCRA) requires that surface coal mine operations return areas to a land use equal to or higher than that which existed prior to mining. In order to address the issues raised by the disturbance and later reclamation of playas located within active mining areas, the Wyoming Department of Environmental Quality, Land Quality Division (WDEQ/LQD) has been in the process of developing a guideline on depressions (playas) for coal mining operators. The draft guideline states:

"...depressions may only be allowed as a replacement feature, it is important that a premining survey be conducted to establish the characteristics and function. The hydrologic function of any depression is the critical concern in evaluating its suitability or success as a post mining feature." (emphasis authors)

This research has as its primary purpose to characterize the unique hydrologic functions of playas within the Powder River Basin of northeastern Wyoming by defining the interrelationships which exist between soils, vegetation and water and how these interrelationships will be important in the restoration of playa areas once they are drastically disturbed by mining activities.

A reconnaissance level survey will be conducted on sixty randomly selected playas during the summers of 1994 and 1995. Transition zones between different vegetation communities will be surveyed. A minimum of one soil sample will be collected from each upland area and each vegetation community within the playa. The soil samples will be analyzed to determine the soil type, soil color, and clay, silt and sand content. Measurement of the playa's length, width, and depth will be made in order to derive a relationship between the playa size and configuration and the water quantity which could potentially be stored within the playa throughout the year.

Detailed surveys will be performed on six playas during the summer of 1995. Ten 1m x 1m quadrants will be sampled in each visibly distinct upland and playa vegetation communities. Production data will be estimated using the Robel Pole method. Soil samples will be taken using a Giddings soil auger. Samples will be collected at one-foot intervals to a maximum depth of 6 feet at each vegetation quadrat. Field analysis will consist of: determination of horizons present, thickness, color, electrical conductivity, pH, reduced iron with alpha-alpha-dipyridyl, surface horizon textural class, dominant subsoil textural class, and depth to water table. laboratory analysis will be performed on one soil profile per playa and will include determination of organic matter content, soluble salts, particle size distribution, and mineralogy.

At least one 4" diameter monitoring well and 2-2" diameter piezometers will be installed in each playa included in the detailed survey. A minimum of two sets of suction cup lysimeters will be installed in each playa for collection of soil water samples. Water quality samples will be collected monthly.

Each playa will be instrumented with a pressure transducer and data logger for continuous recording of surface water levels. Other instrumentation includes a rain gauge, a staff gauge and a Class A evaporation pan. Information gathered from this instrumentation will be used to estimate a surface water budget. Soil moisture readings will be