GEOMORPHIC CLASSIFICATION AND DESIGN OF DRAINAGE SYSTEMS IN THE POWDER RIVER COAL FIELD OF WYOMING[1]

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Abstract: It has generally been recognized that mining of mineral resources alter the landscape, hydrologic regime, and erosional stability of an ecosystem. The reconstruction of an ecosystem following mining disturbance has many facets. An integral part of reconstruction is restoring the hydrologic function and the stability of drainage basins and their stream networks. Currently there are 15 active and several planned or discontinued coal mines in the Eastern Powder River Basin. Each mine will disturb 959 to 13,217 acres based on life-of-mine estimates which extend beyond the year 2025.

The objectives of this study were to: 1) inventory, review and summarize design procedures being used for reconstruction of drainage basins and stream channels in the Powder River coal field in Wyoming; 2) develop a classification system for drainage basins and stream channels in the Powder River coal field based on the natural, physical characteristics of selected small drainage basins; and 3) analyze and summarize the geomorphic methodology and design criteria for reconstruction of drainage basins and stream channels in the Powder River coal field of Wyoming.

A total of 384 drainage basins (64 third order, 128 second order and 192 first order) in Campbell County, Wyoming were selected for analysis from USGS, 1:24,000 7.5 minute, topographic quadrangles. There were 25 geomorphic characteristics delineated and measured for each basin selected. Additionally, field investigations were conducted to quantify cross-sectional and longitudinal profile characteristics of 58 drainage networks. The basins were sorted by order and run through a three tiered multivariate statistical analysis using Principal Components Analysis, Cluster Analysis, and Discriminant Function Analysis. Resultant categories were analyzed and adjusted as necessary after correlation analysis, analysis of variance and regression analysis of key parameters was carried out. First and second order basin classifications were based upon the third order stream to which they wee tributary. Field sampling was carried out on 60 drainage basins (13 third order, 19 second order, and 28 first order) to determine physical drainage network characteristics.

The resulting classification has three strata primarily defined by surface geology, basin area and gross basin slope of the third order drainage basin. Correlation analysis was used to produce reclamation design equations based on field measured parameters within classified drainage basin strata. A primary finding of this study is that channel development is lacking in many first and second order drainages.

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[1]Poster presented at the 1995 National Meeting of the American Society for Surface Mining and Reclamation, Gillette, Wyoming, June 5-8,1995.

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