

GROUNDWATER FLOW CHARACTERIZATION USING GEOGRAPHIC INFORMATION SYSTEMS (GIS) AND GLOBAL POSITIONING SYSTEMS (GPS)¹

By

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ABSTRACT: Groundwater divides and flow paths in Tennessee coal fields were mapped from data entered into a GIS. Well data confirmed the presence of unconfined conditions in mined out workings enabling structural contour maps to be used to predict flow paths. The ARC/INFO GIS was used to map areas of recharge and discharge; these areas were later field verified using Trimble™ GPS units and converted into GIS coverages using PATHFINDER™ software. It was shown that the GIS groundwater coverages accurately predicted most of mine spoil and portal discharge locations. Stream hydrographs of small mined and unmined watersheds were further analyzed to develop a water balance. The USGS Fortran programs “RECESS,” “RORA,” and “PART” were used to calculate groundwater recharge and discharge. The Tennessee Cumberland Plateau coal fields were found to discharge 17 to 22 inches of groundwater annually. Spoil spring and mine portal discharge data were compared with both GIS data and the calculated recharge rates to determine whether the GIS could help predict the discharge quantity of mine springs. The GIS and GPS technology improved the ability to predict the location and discharge amounts of mine springs. This technology enabled an improved Cumulative Hydrologic Impact Study and development of more cost effective ground water monitoring programs.

Additional Key Words: Coal, Mining, Recharge

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