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STREAM FLOW CHARACTERIZATION OVER LONGWALL COAL MINES IN PENNSYLVANIA, OHIO, AND WEST VIRGINIA.

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Project Description and Objectives:

This study assessed the impacts of high-extraction mining (e.g., longwalling) on directly overlying and adjacent streams. Specifically, longwall mining was evaluated with respect to differing geologic and topographic settings, ages of mining, mining depths below stream level, the influence of stream sediment, and angles of draw and dewatering on low-ordered streams. Streams with no visible dewatering impacts were targeted.

Applicability to Mining and Reclamation:

This study has greatly enhanced the understanding of the behavior of streams flowing across unmined into mined and back again into unmined areas. Special emphasis was placed on the influence of overburden thickness, strata lithology, stream sediment thickness and particle size distribution, geomorphology, and position over the longwall panel. The study methods and results can be applied to most other regions throughout the coalfields of the Appalachian Plateau and the mid-continent coalfields.

Methodology:

Six streams in Ohio, Pennsylvania, and West Virginia were evaluated. These streams provided a good range of geologic settings, topographic regions, and mine ages for comparison broadly-differing conditions. Direct stream flow measurements were recorded above (control), within and below the mined areas during periods of high and low baseflow.

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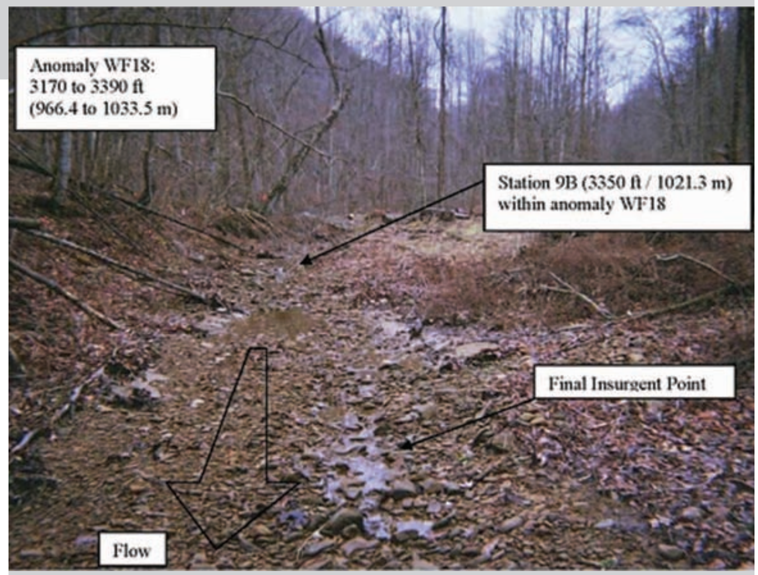
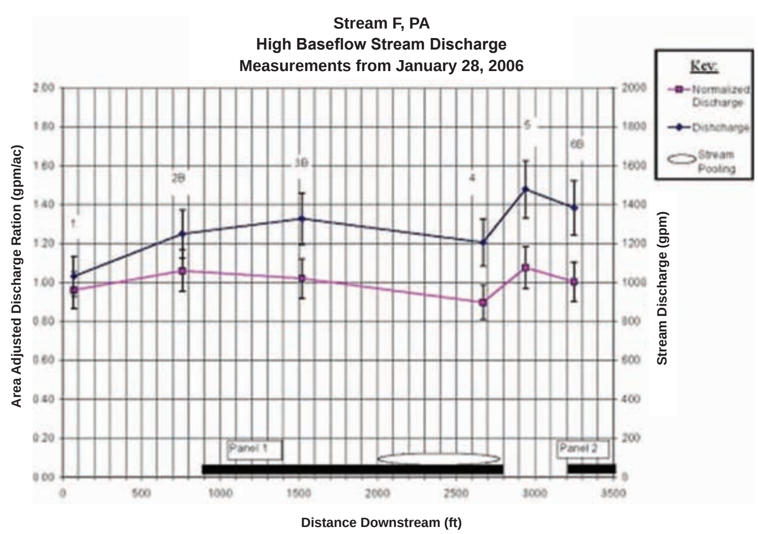


ABOVE PHOTO: West Fork, WV near Station 9b on January 31, 2006.



ABOVE GRAPH: High baseflow stream measurements from January 28, 2006.

Alluvial material thickness and sediment particle size were characterized to assess the stream substrate conditions and to ascertain changes that occurred as a result of subsidence. Electromagnetic (EM) geophysical surveys were conducted along the measured stream reaches using a very low frequency (VLF) and other methods. Data from the geophysical surveys were analyzed for anomalies. Stream measuring stations were established to quantify flow changes that could be associated with the geophysical anomalies.

Highlights:

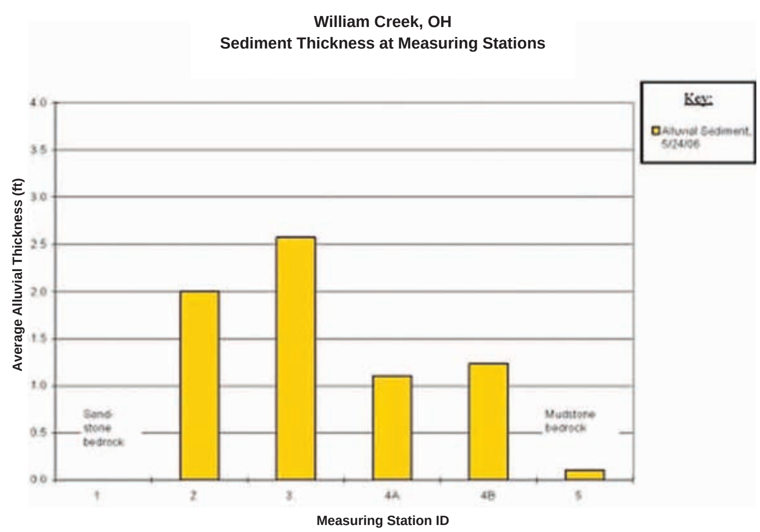
<u>Stream discharge surveys.</u> The stream discharge measurements permitted direct quantification of stream flow losses and gains with respect to the mining location, orientation, differing overburden stresses related to longwall panel sections, changes in substrate sediment (amounts and particle sizes), topography, and geomorphologic conditions. Additionally, analyses of stream flow rates with respect to the different ages of the mining, overburden lithologies and overburden thicknesses were conducted.

<u>Geophysical surveys.</u> Water-filled fractures were identified using EM geophysical surveying techniques. EM techniques (VLF surveys) were successful in locating water-filled fractures by using the relatively higher conductive properties of water in the fractures to differentiate them from the surrounding more resistive rock. Distinct vertical fractures near the edges of longwall panels have been identified using this technology. Electrical Terrain Conductivity, another EM technique which records the apparent conductivity of the shallow subsurface, was used to target potential water loss zones in streams. Stream gaging above and below these targeted fracture zones verified the stream discharge losses or gains.

<u>Stream sediment surveys.</u> The stream alluvial thickness survey entailed driving a three-quarter inch diameter metal rod with a chisel tip into the alluvium until refusal. Three soundings were taken at each stream measuring station, and the average of the soundings was determined. Representative stream reach sediment sampling stations were analyzed in order to help identify potential factors affecting stream flow. Three sediment samples per stream were collected. One sample was collected in the control reach and two samples were located in the reach over the mined panel. Eight different sizes of sediment (64 mm 32 mm, 22 mm, 16 mm, 8 mm 4 mm, 2 mm, and <2 mm) were segregated and weighed.

Results/Findings:

Visible discharge losses were only noted on streams over mines with the least amount of cover and the highest percentage of sandstone coupled with lowest percentage of claystone in the overburden (southern West Virginia). Discharge to drainage area ratios increase across the upstream tension zones during high baseflow and decrease during low baseflow. Streams less than 300 feet above mine level generally recover from the effects of subsidence at high baseflow conditions, but continue to show low baseflow impacts for at least 8 years after mining. Streams greater than 300 feet above mine level generally recover from the effects of subsidence within 15 months for both low and high baseflow conditions.



ABOVE GRAPH: Thickness of alluvium for Williams Creek, OH.

Website Information:

The final project report can be found at **http://www.techtransfer.osmre.gov/NTTMainSite/appliedscience/2005appscience/CompletedProjects/WVUStreamDewaterJHawkins2005.pdf**

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