Hydrological and Geophysical Methods to Investigate Streamflow Losses and Restoration Strategies in Abandoned Mine Lands of Schuylkill River Watershed, Pennsylvania, USA, 2012-2015 [1]

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Abstract: Longitudinal discharge and water-quality campaigns (seepage runs) were combined with surface-geophysical surveys, hyporheic-temperature profiling, and watershed-scale hydrological monitoring to evaluate the locations, magnitude, and impact of stream water losses from the West Creek subbasin of the West West Branch Schuylkill River into the underground Oak Hill Mine complex that extends beneath the watershed divide. Contaminated discharge from the Oak Hill Boreholes to the West Branch Schuylkill River was sustained during low-flow conditions and correlated to streamflow lost through the West Creek streambed. During high-flow conditions, streamflow was transmitted throughout West Creek; however, during low-flow conditions, all streamflow from the perennial headwaters was lost within the 300-to-600-m "upper reach" where an 1889 mine map indicated steeply dipping coalbeds underlie the channel. During low-flow conditions, the channel within the "intermediate reach" 700-to-1650-m downstream gained groundwater seepage with higher pH and specific conductance than upstream; however, all streamflow 1650-to-2050-m downstream was lost to underlying mines. Electrical resistivity and electromagnetic conductivity surveys indicated conductive zones beneath the upper reach, where flow loss occurred, and through the intermediate reach, where gains and losses occurred. Temperature probes at 0.085-m depth within the hyporheic zone of the intermediate segment indicated potential fluxes ranging from -0.53×10^{-5} m/s (upward) during dry conditions to 2.1×10^{-5} m/s (downward) during flowing conditions. Cumulative streamflow lost from West Creek during seepage runs averaged 53.4 L/s, which equates to 19.3 percent of the daily average discharge from the Oak Hill Boreholes and a downward flux of 1.70×10^{-5} m/s across the 2.1-km-by-1.5-m West Creek stream-channel area.

Additional Key Words: Legacy Coal Mining, Surface Geophysics, Surface-water Hydrology, Infiltration

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