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The Role of Retention Basins in Alleviating Post-Mining Streams TDS Levels
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Surface coal mining in the Appalachian Region leaves highly disturbed landscapes of impaired capacity to provide ecosystem services. One of the long-lasting and persistent impacts on stream water quality is total dissolved solids (TDS), frequently exceeding ecoregion benchmark levels. Recent studies documented the high TDS levels in mining-affected streams and the slow recovery to baseline levels to persist long after completion of mining operations and reclamation; with revised prediction of recovery time rates exceeding four decades. In this study, we highlight the temporal and spatial impact of retention basins, located downstream from the disturbed area, on TDS stream water levels in previously reclaimed mountaintop-removal valley-fill operations. Data from an intensively monitored paired-watershed study and three additional watersheds are presented. Stream water TDS levels are monitored on a 15 min intervals at selected locations along the stream - at the toe of the valley-fill and above and below existing retention basins. A system dynamic modeling approach is used to conceptualize the role of the retention basins and to simulate their role in attenuating stream water TDS levels. The study is aimed at establishing a tool enabling the sizing and positioning of such retention basins to achieve desired TDS levels based on minimal data input. Empirical results from the field monitoring stations and the conceptual model and applications will be discussed. The overall hypothesis is that if properly sized and positioned, sediment ponds can be designed with long-term function in mind to be used as TDS mitigating retention basin systems, contributing to mitigating mining impact on stream-water quality long after completing their initially intend role of trapping and retaining sediments during the active mining and reclamation stages.
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