Soil Water Quality of Reforested Mine Site Twelve Years after Reclamation[1]

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Abstract: Forestry reclamation approach (FRA) shown to improve success of reforestation of mine sites in Appalachia by alleviating soil compaction and selection of proper topsoil replacement materials conducive to root growth. Material selection and management practices also expect to affect soil water quality and composition. This study evaluate the effect of FRA practices, namely the use of oxidized vs reduced sandstone spoils as topsoil replacement material, and loose vs compacted placement thereof on soil water quality of a WV mine site[3] 12 years after reclamation. Two large experimental plots (ca. 2.8 hectare each) established in 2005 using brown sandstone or gray sandstone spoils as topsoil replacement material. Each plot was further split into two subplots where the material was compacted or loosely placed. Shallow wells and zero-tension pan lysimeters (30 to 80 cm deep) installed near three random locations within each treatment plot (spoil type x placement practice) during early spring of 2017 to collect and monitor water quality. Water samples were collected weekly from June to mid-November, 2017 and analyzed for elemental and ionic composition, total alkalinity, total and organic and inorganic carbon, as well as dissolve oxygen, pH, temperature, and redox potential. Initial results showed levels of alkali and alkaline earth metals within the range of benchmark reference values for surface water in WV (0.8 – 1.9 times the reference levels) while that of Fe, Mn were much higher (878, and 604 times the reference levels of 0.019, and 0.016 mg L-1, respectively). Levels of heavy metals were elevated as well (1.8, 23, and 37 times the reference levels of 0.0076, 0.0027, and 0.0008 mg L-1, for Ni, Zn, and Cu, respectively). Overall, redox processes and seasonal variation therein seemed to govern metal solubility, nitrogen speciation, and pH of the reclaimed mine site soil solution 12 years after reclamation.

Additional Key Words: redox potential, spoil, brown sandstone, Forestry Reclamation Approach

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1. Oral paper presented at the 2018 National Meeting of the American Society of Mining and Reclamation, St. Louis, MO: The Gateway to Land Reclamation, June 3 - 7, 2018. Published by ASMR; 1305 Weathervane Dr., Champaign, IL 61821.

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3. Work reported here was conducted near 38° 02’ 42” N; 81° 30’ 30” W.