

## **Using New and Innovative Landslide Repair Techniques for Landslide Mitigation and Erosion Control**

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### **Abstract**

Shallow landslides along our nation's roadway networks and residential areas are a perennial drain on budgets and personnel resources at all levels of government. Ironically, costs for investigation and design can sometimes exceed actual construction costs. One specific application where landslides occur is coal mine refuse piles where coal processing waste material was deposited along the sides of hill slopes or into hollows. While not always the case, typically prior to the 1977 Surface Mining Act, this coal refuse was dumped along a hillside or hollow without compaction or attention to drainage control or erosion. Over time the "new" slope significantly displaces, typically due to undercutting, or undergoes severe erosion, and needs to be stabilized.

Before selecting what type of mitigation is most appropriate for a particular slope, it is necessary to distinguish between surficial problems and deeper instability. Surface instability is characterized by material moving down the slope under the influence of gravity. Depending upon the site conditions, this material can include soil, mud and debris, rocks and boulders, or coal refuse. Deeper instability or landsliding consists of the movement of a mass of material along planes of weakness.

This paper will address the wide variety of mitigation measures available to address these stability concerns. Surficial problems can be addressed by use of slope matting material (geotextiles or wire mesh, etc.), shotcrete facing, and/or other methods. Deeper instability typically necessitates more extensive mitigation measures such as pattern anchoring both with and without a facing material (meshes or shotcrete, etc.) and new innovative techniques will be explained including Launched SuperNails<sup>®</sup>, Geosynthetically Confined Soil<sup>®</sup> Walls and SuperMicropile<sup>™</sup> foundations.

Also included is a detailed case study from an emergency landslide reclamation project for the Virginia Department of Mines, Minerals and Energy in Buchanan County, Virginia. This project included the stabilization of a 2,000 square foot area behind an occupied residential dwelling with steep terrain and difficult access.