FIELD INVESTIGATION OF BEST PRACTICES FOR STEEP SLOPE MINE RECLAMATION EMPLOYING THE FORESTRY RECLAMATION APPROACH

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Bridging Reclamation, Science & The Community  
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Objectives

- Regional inventory of highwall elimination methods on steep-slope mines throughout the Appalachian region

- Field investigation of application of FRA on steep-slope mines emphasizing operational, economical & stability perspectives
A total of 28 mine sites were visited throughout the Appalachian region.
Field Investigations

- Compare operational efficiency and project economics with FRA reclamation to non-FRA reclamation
- Characterize the level of compaction
- Evaluate the stability of steep-slopes that were reclaimed using FRA
Description of Experimental Site

- Approx. 4.7 acre Peel Poplar site reclaimed by combination of truck and lateral dozer push by ICG in Pike County, KY

- Volume of backfilled material: 760,000 yd$^3$

- Height of highwall reclaimed is approx. 173 ft and slope angle ranges from 27° to 33° (Average angle 29°)

- Approx. half of the site consists primarily of Gray sandstone and the other half has a top layer of soil and Brown sandstone
Cross-sectional Profile of Slope

Top 4 ft Loose Materials
Highwall Elimination Activities

Lateral Pushing of Spoil
Highwall Elimination Activities

Grading Work
Single pass grading was done by Dozer Cat D11R from top to bottom.

Passes did not overlap & small ridges were left between passes.
Planting Activities

Planting in Gray Area
## Trees Inventory

<table>
<thead>
<tr>
<th>No</th>
<th>Common Name</th>
<th>Scientific Name</th>
<th>No of trees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>White Oak</td>
<td>Quercus alba</td>
<td>713</td>
</tr>
<tr>
<td>2</td>
<td>Black Oak</td>
<td>Quercus velutina</td>
<td>713</td>
</tr>
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<td>3</td>
<td>Black Cherry</td>
<td>Prunus serotina</td>
<td>713</td>
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<td>4</td>
<td>Sugar Maple</td>
<td>Acer saccharum</td>
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<td>5</td>
<td>Yellow Poplar</td>
<td>Liriodendron tulipifera</td>
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<td>6</td>
<td>Northern Red Oak</td>
<td>Quercus rubra</td>
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<td>7</td>
<td>Gray Dogwood</td>
<td>Cornus racemosa Lam</td>
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<td>8</td>
<td>Eastern redbud</td>
<td>Cercis Canadensis</td>
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<td>9</td>
<td>White Pine</td>
<td>Pinus strobes</td>
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<tr>
<td>10</td>
<td>American chestnut</td>
<td>Castanea dentata</td>
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**Total number of trees:** 4327
Field Measurements

- Spoil measurement;
- Bulk density
- Penetration resistance
- Depth of refusal (Maximum penetration depth)

- Surveying of monuments for mass movement

- 70 (31-Gray Area & 39 Brown Area) steel rebars (1/2 inch -dia & 4 feet length) are driven to monitor mass movement
Penetrometer

Wildcat Dynamic Cone Penetrometer-Field set up
Penetrometer Monitoring Points
Maximum penetration depth
(Initial Measurements)

Blue bar-Gray Area
Red bar-Brown Area

Depth of refusal (cm)

Line Number

1 2 3 4 5
Nuclear Density Gauge

Troxler 3440-Nuclear Density Gauge-Field set up
Bulk Density Monitoring Points
Bulk Density Measurement
(Initial Measurements)

Dry Bulk Density (6'')

<table>
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<th>Density (g/cm³)</th>
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<tr>
<td>1.35</td>
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<td>1.6</td>
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<th>2011</th>
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<tr>
<td>2</td>
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</table>

1- Brown Spoil
2- Gray Spoil
Movement Monitoring

Survey of Monument
Survey of Monuments

Total Station set up for Survey of Monuments
Location of Monuments
Current Analysis

- Spoil measurement
- Bulk density & penetration resistance

- Surveying of monuments for mass movement

- Economic analysis of reclamation cost will be done

- Trees survival rate
QUESTIONS??