Reclamation at Badger Mining’s Taylor Plant

SAND MINE LIFE CYCLE SEMINAR

May 12, 2017
Mine Life Cycle Timeline

- 500 million years ago
- 30,000 to 10,000 years ago
- Last 200 years - forestry
- 5 – 30 years active mining
- In the future ???
• BMC Taylor Plant ~ 6,000 acres
Including:

- 313 plant species
- 155 bird species
- 22 mammal species
- 9 amphibian species
- 7 reptile species

Yes – we counted.
• Identify potential mining areas.

• Understand the quality characteristics of the sand.

• Quantify the costs associated with mining the area – overburden removal, environmental risk, screening and visibility.
• Identify resources susceptible to impact – historical, archeological, wetlands, wildlife, streams.

• Anticipate potential impacts from mining activities.

• Devise protection plans to prevent impacts - erosion control, storm water management, buffer zones, etc.
• Identify areas for timber harvest.

• Plan access routes, staging areas, Trucking activities.
• Identify overburden removal areas.

• Plan access roads, optimize haul distances.

• Erosion control & stormwater planning.
Drilling & Blasting

• Shot sequencing.
• Blast design.
• Monitoring & continuous improvement.
• Mining efficiently & cyclically.

• Minimizing haul distances & overall process footprint.

• Managing operational constraints – weather, pit runs, grading & drainage.
Slimes & Tailings

- Material Characteristics
- Planning Storage Areas
- Feed/Return Systems
- Monitoring
• Fill sites for overburden & waste rock placement.

• Stormwater management

• Anticipate highly erosive areas.

• Slope stability
Re-establishing terrain to approximate original site qualities or meet other post-mining land use goals.
Reclamation Considerations

- Consistency with surrounding topography & land uses
- Efficiency of transporting materials
- Watershed and storm water management
- Erosion control
- Water infiltration rates
- Compaction issues
- Carbon sequestration
- Vegetation layer with the most benefits
Vegetation Establishment

#1 goal is to get the site stabilized as quick as possible
  • Mulch and cover crop

#2 goal is to establish a permanent mix of perennial species
  • Prairie
  • Cool season Mix
Vegetation Establishment - Planting

Planting Methods

- Mechanically Broadcast
- Hand Broadcast
- Drill

- We use all 3 planting methods. The method used is dependant on time of year and slope steepness.
Specialized broadcast seeder designed for prairie seed (fluff)
- Low volume (7 – 10 lbs/acre)
- 7-8 ft spread
- Planting rate accuracy moderate
- Moderate on steep slopes

Broadcast seeder designed for cover crop
- High volume (50 – 100 lbs/acre)
- 12-15 ft spread
- Works well on steep slopes
- Seed to soil contact is moderate
- Seed exposed to herbivores
• Works well on steep areas
• Handheld broadcaster works for cover crop or high volume seed
• Seed to soil contact is moderate
• Seed exposed to herbivores
• Labor intensive but effective
Planting - Hand Broadcast

- Sand and seed mix (low volume mixes)
- Works for steep areas
- Labor intensive but effective
- Light snow cover helps with placement
- Utilizing freeze and thaw for seed to soil contact
Planting - Drill

- Can plant all seed mixes in one pass (cover crop and prairie)
- Can be difficult on steep slopes
- Good seed to soil contact
- Good accuracy on seed placement and rate
- 8 ft planting width
Vegetation Establishment - Mulching

- Use a large scale mulcher or bale chopper
- Applied at 2 to 3 tons/acre (4-5 bales/acre)
- Clean weed free oat straw and hay
- Crimped in by dozer or grain drill
- Can spread up to 35 feet
Crimping mulch in by planting over
Pre-construction view of the “Pickle Park” Geomorphic Land Reclamation Project looking South-West
### Slope Report

Surface File: 100511 Duck Blind Reclaim 6
Number of 3DFaces analyzed: 1240

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<th>Zone</th>
<th>Horizontal Surface</th>
<th>Area S.F.</th>
<th>% of Total</th>
<th>Acres</th>
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Total: 254,450.0 | 5.841

Average Slope: 19.4%
Minimum Slope: 0.4%
Maximum Slope: 48.2%
3D CAD view of the “Pickle Park” Geomorphic Land Reclamation Project looking South-East
Pre-Stabilization view of the “Pickle Park” Geomorphic Land Reclamation Project looking South-East
Post Construction View of the “Pickle Park” Geomorphic Land Reclamation Project Looking South-West
Stabilized view of the “Pickle Park” Geomorphic Land Reclamation Project looking South-East
Cover or nurse crop

- Initial plant that helps stabilize the soil
- We use a certified oat seed or winter wheat
- Certified seed is much cleaner (weed free)
- Grows quickly (1 – 2 weeks)
- 1 year deal
Vegetation Establishment - Prairie

Prairie

- We plant prairie with a cover crop
- Mix is made up of 30 species; 6 grasses and 24 forbs
- Plant at 8 – 10 lbs/acre
- Seed cost is about $300.00/acre
- Permanent cover but it takes time to mature
Conclusion

- Reclamation is one part of the mine life cycle.

- Utilizing geofluvial principles in combination of establishing a native plant community with land reclamation will help mimic a natural landscape that provides more benefits for soil, water quality, wildlife, and overall aesthetics.
QUESTIONS / COMMENTS

THANK YOU & HAVE A GREAT DAY!