The Future of Tailings Management

The Rock-stars
History

HackMining - Toronto

Transporting ore and waste from difficult-to-access areas

HackMining - Toronto

Reducing the volume of mine tailings
Our Team

Anas Chazi - Third year mining engineer student at McGill University
-Civil engineering technologist

Nicolas Germain - Recent Mining Engineering Graduate

Mohamed Zaki - Mining Engineering student at McGill University.
-Interested in innovation in the bio-mining sector

Henry Luan - Third year Applied Math Student at the University of Toronto

Adam Stanley - Third year mining engineering student at McGill University
Today’s Tailing Dilemma

Vast Land Coverage
The dams cover huge amounts of land and damage the surrounding ecosystem

Risk of Failure
Disasters such as Mount Polley and Saramco are ever present concerns

High Maintenance Costs
Millions are spent by companies to maintain the stagnant tailing ponds

Negative Social Repercussions
Local stakeholders must deal with unsightly and dangerous ponds

Difficulty of Reclamation
After operations, these ponds must be restored to their previous state which requires large capital investments

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Tailing Management of Tomorrow

- Electrokinetic Geosynthetic Grid
- Geotubes
- Geopolymer Cement
- Road Building & Infrastructure

Volume Reduction
Storage and Dewatering of Fines
Reuse of “Waste”
Mixed Strategy
# Method Mechanics

<table>
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<tr>
<th>Electrokinetic Geosynthetic Grid</th>
<th>Geotubes</th>
<th>Geopolymer Cement</th>
<th>Roads &amp; Infrastructure</th>
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<tr>
<td>Separates water and tailings</td>
<td>Customizable dimensions</td>
<td>Utilizes industrial waste</td>
<td>Road base made of geotubes</td>
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<td>Durable material</td>
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<td>Contains hazardous byproduct</td>
<td>Turns tailings into valuable cement</td>
<td>Connects communities</td>
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<td>Eliminates need for shipping</td>
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<td>Grid cracks and desiccates tailings to permit water accumulation</td>
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  - Customizable dimensions
  - Durable material
  - Contains hazardous byproduct
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- Geopolymer Cement:
  - Utilizes industrial waste
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- Roads & Infrastructure:
  - Road base made of geotubes
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  - Connects communities
  - Enhances exploration
  - Lowers dam footprint
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- Geosynthetic Grid:
  - Connects communities
  - Enhances exploration
  - Lowers dam footprint
  - Allows rural development and exploration

- Energy efficient and self contained

- Efficient dewatering and construction material

- Cheap, high quality cement
Electrokinetic Geosynthetic Grid (EGG)

**Purpose**
Efficient dewatering & water recycling

**Method**
Apply voltage across a grid of positive and negative electrodes

**Result**
Water flows to negatively charged cathode and is pumped out
Comparison to Portland Cement

**Sodium Hydroxide Costs**
- NaOH: $125/ton
- Concentration: 0.40-0.60 g/cm³

**Overall Costs per Cubic Meter**
- Geopolymer: $49-74
- OPC: $191-251
Road Development & Cost Analysis

Scenario 1
• 11 small diameter (1 m) geotubes as road base
• Costs: $72,000-98,000* per 100 m

Scenario 2
• 2 large diameter (3 m) geotubes as road base
• Costs: $49,000-67,000* per 100 m

Scenario 3
• 3 Layers of 2 geotubes making a 3x7 m road
• Cost of $23-35 million for a 65km road

*High contingency in calculation
Geotubes as Structural Base

- Utilized as island perimeter in the Amwaj Islands
- Demonstrates versatility of Geotube technology
- Adequate mechanical properties for construction material
Geotube Utilization – Further though

Structural purposes: raising embankment, dams, dykes, etc.

Geotubes

Dam

pond

Beached tailings

Capturing acid mine drainage and other toxic effluents

Capture water for reutilization followed by Reclamation
Realized Benefits

- Economic
- Social

- Reduction in Dam Cost
- Government Grants
- Lower Reclamation Effort
- Unites Communities
- Decrease Footprint
The Road Ahead

- **Sustainability**
  By finding a use for the tailings, traditional tailings management is disrupted

- **Value from Waste**
  Instead of losing money on tailings, costs can be recouped

- **Enhanced Stakeholder Relations**
  Minimizing dam impact and increasing safety positively impacts local communities

### Method Development
- R&D and extensive proof of concept
- Create a prototype road to market

### Investor Generation
- Operational tailing roads bring interest from industry players

### Partnerships
- Develop commercial relations with third parties

### Full Scale Implementation
- After partners have been made, our integrated method can be employed

### Optimization
- Gather feedback and data from stakeholders to produce an increasingly refined product

- Incentives for government grants in innovation and sustainability
- Provincial and Federal Government partnerships
- Target exploration and junior companies

- Create deals with producers for their tailings
- Generate interest in rural communities for infrastructure projects
Innovation Potential

Geotubes, Geopolymers & Infrastructure
• Proven technology that has yet to reach full potential in the mining industry
• Potential for tailing recycling
• Modular roads, allowing for easier, quicker construction
• Geotubes can be replaced with loose tailings and reinforced with polymer cement

Electrokinetic Geosynthetic Grid
• Cutting edge solution to traditional tailings management
• Backed by University research and testing
• Contained units allow for economies of scale
• On the verge of widespread production
Where are we Today?

**Geotubes → Proven**
- Tests show rapid dewatering
- Effective in tailings containment

**Geopolymer → Proven**
- Used in bricks
- Undeveloped in industry

**EGG → Proven**
- Extremely promising technology
- Small dewatering footprint

**Tailing Roads → Probable**
- Must be prototyped
- Scaling needs tested

**Prototypes → Of course!**

**Exploration Avenues?**
- Montreal Entrepreneur Community (McGill University Hub & Centre de l’innovation)
- Governmental Expertise
Multiple mining problems tackled

Stakeholder Incorporation

Unlocking untapped lands
SPECIAL THANK YOU TO

BISHOP WATER  McGill

GET IN TOUCH WITH US!
THANK YOU
QUESTIONS?

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