Sulfide Mining In Michigan

Assessing the Value of Sulfide Mining in Michigan’s Upper Penninsula.
Guiding Principle: Value Creation

Businesses, community leaders, environmentalists, and personal activists will judge an issue from their own set of values. We look across value models.

Value Balanced Scorecard

- Will businesses make money?
- Will communities prosper?
- What are the benefits toward improved quality of life for individuals?
- Is there a contribution toward a balanced ecosystem?

Corporate Value

Social Value

Personal Value

Environmental Value
Why Is WP Interested in Eagle

Sulfide Mining is on the short list of Michigan’s environmental challenges due to the risk of acid mine drainage and the size of the impacted areas.
Seven Mines Studied

We selected seven mines to study based on 1) those that had many characteristics of a “21st Century Mine” and 2) those with similarities to what we assume to be the characteristics of Eagle.

<table>
<thead>
<tr>
<th>Mining Site</th>
<th>Eagle</th>
<th>Flambeau</th>
<th>Gr. Creek</th>
<th>Ridgeway</th>
<th>Carbon</th>
<th>Voisey</th>
<th>Raglan</th>
<th>Lowcoast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mining Operation</td>
<td>Open Pit/DB (reclamation stage)</td>
<td>Underground/Cut &amp; Fill (proposed)</td>
<td>Underground/Cut &amp; Fill (operational)</td>
<td>Open Pit/DB (inactive proposal)</td>
<td>Open Pit/DB; Underground/Cut &amp; Fill (proposed, construction started)</td>
<td>Open Pit/ST; Underground/Cut &amp; Fill</td>
<td>Underground/Cut &amp; Fill (operational, expected to close in 2005)</td>
<td></td>
</tr>
<tr>
<td>Mineralogy</td>
<td>Copper, Silver, Gold, limited buffering</td>
<td>Copper, Silver, Gold, Limited buffering</td>
<td>Zinc, Lead, Silver, Gold, significant buffering capacity</td>
<td>Gold</td>
<td>Zinc, low buffering capacity (?)</td>
<td>Nickel, Copper, Cobalt</td>
<td>Nickel, Copper, Cobalt, Plat. Grp., Palladium</td>
<td>Copper, Zinc, Gold, Silver</td>
</tr>
<tr>
<td>Hydrology</td>
<td>Close proximity to headwaters of two low flow drainages</td>
<td>Close proximity to high flow river</td>
<td>Close proximity to moderate river, treated discharge to sea water outfall, very dry mine</td>
<td>Pit lake is filling with water, wetlands mitigation in progress, bedrock at surface</td>
<td>Close proximity to numerous lakes and rivers, permafrost setting</td>
<td>Close proximity to numerous lakes and rivers, permafrost setting</td>
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</tr>
</tbody>
</table>

**Notes:**
- Strong Fit with Eagle
- Moderate Fit with Eagle
- Weak Fit With Eagle
Key Finding #1: Financial Inequities

Our first key finding is that our case mines resulted in a great inequity between those that benefit from mining and those that bear the cost of it’s inherently invasive nature.

<table>
<thead>
<tr>
<th><strong>Eagle Winners</strong></th>
<th><strong>Eagle Losers</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Owners</td>
<td>Outdoor Recreators</td>
</tr>
<tr>
<td>Employees</td>
<td>Wildlife</td>
</tr>
<tr>
<td>Taxing Authorities</td>
<td>Residents</td>
</tr>
<tr>
<td>Royalty Owners</td>
<td>Communities</td>
</tr>
<tr>
<td></td>
<td>Competing Land-Use</td>
</tr>
<tr>
<td></td>
<td>Industries</td>
</tr>
<tr>
<td>+ $2.8B</td>
<td>- $?.?B</td>
</tr>
</tbody>
</table>
What Is the Payout?

What we can say about the losers is that they are in greater numbers than the winners and they are nine times more likely than the winners to live in Michigan.

**Value Creation Calculation**

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Per Annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net smelter returns</td>
<td>4.7B</td>
<td>782M</td>
</tr>
<tr>
<td>Operating costs</td>
<td>.8B</td>
<td>133M</td>
</tr>
<tr>
<td>Operating Margin</td>
<td>3.9B</td>
<td>649M</td>
</tr>
<tr>
<td>Depreciation, Royalties</td>
<td>.525B</td>
<td>90M</td>
</tr>
<tr>
<td>EBIT</td>
<td>3.375B</td>
<td>559M</td>
</tr>
<tr>
<td>EVA</td>
<td>3.3B</td>
<td>500M</td>
</tr>
<tr>
<td>NPV</td>
<td>2.885B</td>
<td></td>
</tr>
</tbody>
</table>

**Typical Value Distribution**

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>%</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kennecott Shareholders</td>
<td>1,875M</td>
<td>73</td>
<td>* Really, these are Rio Tinto shareholders</td>
</tr>
<tr>
<td>Feds</td>
<td>470M</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>State Taxing Authority</td>
<td>166M</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>Royalty Owners</td>
<td>50M</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Municipalities</td>
<td>19M</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>Employees</td>
<td>125M</td>
<td>6</td>
<td>** Less than half of employee wages are likely to go to local people</td>
</tr>
</tbody>
</table>

* Adds up to 106% because the six percent that represents wages is not part of earnings, but is an expense
Key Finding #2: Socio-Economic Failings

Our second finding is that the evidence shows growing negative impacts on income, unemployment and poverty, especially in the Great Lakes region.

**Freudenberg and Wilson study of 301 mining-dependent communities**

- Mines often “sold” to communities based on *improvements* in income, unemployment rates, and poverty rates.

- Actual findings that most had *worsened income, unemployment rates, and poverty rates* at time of closing:
  - More than 60% of all communities
  - more than 85% in the great lakes region,
  - more than 70% of those that have closed since 1982
Key Finding #3: Site Sensitivity

Permits are set at a level of damage that someone determines a location can handle. The due diligence in setting those levels predetermines how much damage there will actually be.

Meeting Permitted Levels Does Not Mean There Is No Pollution

Permit levels must be appropriate for a particular site
Key Finding #4: High Risk Technology

Our fourth key finding is that sulfid mining technology is not mature. There is no reusable “21st Century Mining Technology”.

**21st Century Mining Defects**

**Unable to predict outcomes with high degree of precision**
- significantly higher levels of metals and significantly lower PH than predicted at Flambeau

**Release of toxic chemicals (may be within permit rules”)**
- 59 million pounds of toxic chemicals released in 2000 and 15,000 pounds of persistent bioaccumulative toxins (PBTs) released per year at Greens Creek
- Permitted releases of cyanide to the air in Ridgeway lead to local residents testing positive for cyanide in their blood

**Ruptured lines and liners**
- Failure of Berm around High Sulfide Waste Rock Pile at Flambeau
- 134 reported problems with waste rock liners at Flambeau
Key Finding #5: High Risk Management

Our fifth and final key finding is that the mines we studied all had significant defects and many of those defects were caused by failures of management vs failures of technology. Quality programs are not yet prominent in this industry.

### Flambeau Management Defects:

<table>
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<tr>
<th>Defect</th>
<th>Root Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 1997 two waste rock liner holes undetected for two years</td>
<td>Liner damaged by equipment and inspections not made</td>
</tr>
<tr>
<td>2. Offsite Stream “C” found with elevated copper up to 30 ug</td>
<td>No monitoring plan for streams just off mine site – pre, during, and after mining</td>
</tr>
<tr>
<td>3. Discharge from abandoned rail spur sent up to 500 ug of copper sulfide into bio-filter pond and then to Stream “C”</td>
<td>Improper initial remediation of rail spur where ore was crushed and loaded for transport</td>
</tr>
</tbody>
</table>
Progress To Date

The State of Michigan is moving in the right direction with current draft legislation, but the real test has been deferred to rulemaking.

**Draft Legislation:**

- A permit shall be required for sulfide mining.
- Sulfide mines shall be bonded prior to receiving a permit.
- The permitting process will have ample opportunity for public input and public access to the application and supplementary documents.
- An Environmental Impact Assessment shall accompany all applications.
Need: Broad Value Model

There is not enough data available to conclude that Eagle is anything but a very high risk investment. We are not ready to process permit requests in Michigan.

You Cannot Manage What You Do Not Measure

- What is the track record of the technology?
- What is the process competency of the operator?
- What are the financial needs and sourcesability to remediate a site and reconcile potential damages?
- What are the measures of the location’s sensitivity to expected by-products of mining?
- What are the likely socio-economic effects on an area?
- What is the value of recreational opportunities lost?

How Much Degradation of Quality of Life is Expected? How Much Is Justifiable?
Need: Broad Site Evaluation

The costs of mining can be very large or relatively small, based on characteristics of the location.

- Proximity, volume, flow, and baseline purity of streams and aquifers affect quality of water
- Lowers desirability as a place to live and visit
- Risk of losing endangered or environmentally sensitive species
- Transient nature of work can raise unemployment in smaller, less diverse local economies
- Unemployment places strain on community services, like education.
- Crime follows blight
- Competition with existing land-use based industry
Need: Quality Certification Requirements

The costs of mining can also be very large or relatively small, based on the management, process, and technical capabilities of the operator.

**Michigan Sulfide Mine Operators Must:**

- Certify Processes against ISO14001 standards
- Achieve “6 Sigma” improvements
- Meet EIS Requirements
- Utilize Best Practices
- Demonstrate Financial Ability to fund restitution, reclamation, and remediation
- Ensure standards of processes are maintained by continuous review and monitoring studies
Need: Access to World Class Expertise

The only way that we can improve our picture of value creation/destruction is to tap the most qualified sources of objectivity and expertise.

**Improve Sources of Expertise**

- Obtain full environmental baseline from neutral sources such as the USGS for full Hydrogeologic Assessments of the affected areas.
- Leverage expertise from informed sources such as the EPA, Mining Industry consultants, Economic Assessment consultants, etc.
- Socio-Economic expertise from Academia.
- Develop in-depth analyses of operators that fully disclose financials, past performance, technological expertise, etc.
Rulemaking Challenge

Value to the public will be created or destroyed by sulfide mining based on whether rulemaking provides adequate controls. How will the state respond to these needs?

1. How will a long term value prospect of a mine be determined?
2. What will be done to ensure that complete baseline data is gathered on a site before any activity is permitted?
3. How will socio-economic effects be forecast?
4. How will it be determined whether a location is suitable or not suitable for mining based on science?
5. How will operators be certified as responsible based on past performance to standards?
6. From what internal and external sources will regulating agencies acquire, develop, and retain deep, objective expertise?
7. How will we ensure that there is adequate public participation and understanding to ensure transparency of operation?
8. Who is going to cover the cost to administer this program?
9. How can recycling be made more economical?
What Can You Do?

Don’t assume that someone else will protect the interest of the communities and individuals affected. Our research shows that an active community is mandatory (though not sufficient) for a fair outcome.

**Active Communities:**

- Educate themselves
- Seek objective, expert involvement
- Challenge assumptions
- Think long term
- Make use of public input opportunities

**Be An Active Community:**

1. *Support proposed legislation*
2. *Be Active in the rulemaking process!*
3. *Be Active in the permitting process!*
Wolfpack