Site 23/D

June 2, 2009
• Placement data

• Stability
  – Compaction
  – Inspections
  – Slope monitoring

• Water level data

• Precipitation and flow data

• Water quality at internal monitoring sites

• ABA data

• General site management
Table 3.1 Site 23 Placement Data

<table>
<thead>
<tr>
<th>Year</th>
<th>Surveyed (cy)</th>
<th>Surveyed (tons)</th>
<th>Hauled To Tails (tons)</th>
<th>From UG Truck Counts (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monthly</td>
<td>Cumulative</td>
<td>Monthly</td>
<td>Cumulative</td>
</tr>
<tr>
<td>2007</td>
<td>48,441</td>
<td>600,522</td>
<td>82,000</td>
<td>1,016,588</td>
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<tr>
<td></td>
<td>251</td>
<td>40,690</td>
<td>45,662</td>
<td>34,437</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>65,852</td>
<td>145,951</td>
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<tr>
<td>2008</td>
<td>24,432</td>
<td>619,999</td>
<td>41,358</td>
<td>1,049,528</td>
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<tr>
<td></td>
<td>251</td>
<td>25,012</td>
<td>28,041</td>
<td>11,091</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>8,414</td>
<td>47,546</td>
</tr>
<tr>
<td></td>
<td>~492,000 tons remaining</td>
<td></td>
<td>Production % by class</td>
<td>59% 23% 18%</td>
</tr>
</tbody>
</table>
were does class 1 placed and "less tails haul" come from?
ballouc, 4/28/2008
Site 23/D Stability

- **Compaction**
  - Method specification includes spreading in less than 24” lifts with at least one pass with bulldozer and four passes with vibratory compactor

- **Inspections**
  - Results of operator, engineering, environmental and regulatory inspections revealed no visible signs of instability
  - No issues of non-compliance were noted in 32 USFS and 1 ADEC/ADNR inspections

- **Slope monitoring**
  - 12 survey hubs monitored with GPS
    - No large movements were identified
  - Inclinometer readings
    - Minor creep at 85’ (~3mm/yr)
Figure 3.30 Inclinometer Incremental Displacement
Site 23/D Water Level Data

- Water table is below base of pile
- Well-drained pile and foundation indicate pile stability is maximized
- Perched water tables in colluvial wedge and alluvial sands
- Braided flow paths
- Distinct seasonal pattern, especially in alluvial sands
- Silt/clay till below colluvial wedge inhibits downward water movement
Figure 3.1 Pressure Data for Piezometer 52
Figure 3.6/7 Water Levels
MW-23-A2S/D

WATER ELEVATION (FT-MSL)

1/15/1995
1/15/1996
1/15/1997
1/15/1998
1/16/1999
1/16/2000
1/16/2001
1/16/2002
1/16/2003
1/17/2004
1/16/2005
1/16/2006
1/17/2007
1/17/2008
1/17/2009

DATE
Figure 3.9 Water Level Data for Well MW-23-A4
Figure 3.11 Water Level Data for Well MW-94-D3
## Table 3.2 Monthly Summary of Site 23/D Climate Data

<table>
<thead>
<tr>
<th>Month</th>
<th>Avg Temp ( °C )</th>
<th>Precipitation (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>-4.48</td>
<td>4.17</td>
</tr>
<tr>
<td>February</td>
<td>-3.29</td>
<td>3.74</td>
</tr>
<tr>
<td>March</td>
<td>-0.06</td>
<td>5.15</td>
</tr>
<tr>
<td>April</td>
<td>1.71</td>
<td>5.45</td>
</tr>
<tr>
<td>May</td>
<td>6.59</td>
<td>3.8</td>
</tr>
<tr>
<td>June</td>
<td>8.32</td>
<td>2.45</td>
</tr>
<tr>
<td>July</td>
<td>10.55</td>
<td>7.15</td>
</tr>
<tr>
<td>August</td>
<td>11.09</td>
<td>4.76</td>
</tr>
<tr>
<td>September</td>
<td>8.28</td>
<td>8.27</td>
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<tr>
<td>October</td>
<td>3.44</td>
<td>15.74</td>
</tr>
<tr>
<td>November</td>
<td>0.92</td>
<td>6.02</td>
</tr>
<tr>
<td>December</td>
<td>-4.94</td>
<td>3.92</td>
</tr>
<tr>
<td>2008</td>
<td>3.18</td>
<td>70.62</td>
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</tbody>
</table>
Site 23/D Internal Monitoring Sites: Water Quality Data

- Internal site waters are captured, treated and discharged per HGCMC’s NPDES permit
- pH values are between 6.0 and 8.5 (high buffering capacity)
- Conductivities are between 200 and 5000 umho/cm
- Variations in conductivity reflect differences in contributions of groundwater and infiltration, seasonal fluctuations
- Zinc concentrations are variable (typically less than 5 mg/l)
- Precipitation, mixing and sorption mechanisms determine metals concentrations
Figure 3.14a Site 23 Finger Drains pH
Figure 3.17a Site 23 Finger Drains Conductivity
Figure 3.20a Site 23 Finger Drains Dissolved Zinc
Site 23/D Wells and D Pond
Figure 3.14b  pH
Site 23/D Wells and D Pond
Figure 3.17b Conductivity

MW23-A2D (50)
MW23-A4 (51)
MW-D3 (53)
Pond D (331)
Site 23/D Wells and D Pond
Figure 3.20b Dissolved Zinc
Figure 3.28 ABA Data
Underground Rib Sampling

FIGURE 3.28  2008 ABA DATA FROM UNDERGROUND RIB SAMPLES

Acid Potential Potential (tCaCO3/kt)

Neutralization Potential (tCaCO3/kt)

Class 1 (NNP>+100)

Class 2 (NNP>-100,<+100)

Class 3 (NNP>-300,<100)

Class 4 (NNP<300)

Visual

Class 1
Class 2
Class 3
Class 4
Site 23/D General Site Management

- Designated placement zones are marked on the active lift of the site and production rock is placed according to class
- Outer surfaces have at least two feet of Class 1 rock
- Class 2 and 3 rock are blended and placed in the center of the pile
- Use of interim storage area for reclamation activities

- 1350
- B Pond berm
- Pipeline excavation
Cover Design

Growth Medium
Capillary Break
Barrier Layer
Capillary Break

2 meters
Site 23 Cover Excavation
Cover Performance Monitoring

- About 85% of the water collected in the chalet trench system reported via the upper capillary break
- The growth medium contributed 15% of trench flow and the barrier layer flow was 0.2%
- The lag time between peak precipitation and peak trench flow is about 6 hours for dry conditions and 2 hours for wet conditions
- Modeling with Hydrus-2D/3D software compares favorably with field results
- Greater than 85% water saturation in barrier layer minimizes oxygen ingress
- Water percolation through barrier layer 15-20% of annual precipitation
- Barrier layer does not freeze during the winter
- Numerical modeling of alternative cover designs indicates that the upper capillary break is necessary to maximize lateral flow and prevent buildup of head pressures in the growth medium and barrier layer
B Road Pipe Bedding Removal and 18” Line Installation
B Pond Berm Removal and Pump Installation
1350 Waste Rock Removal
960 Site Waste Rock Removal
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>Before</th>
<th>After</th>
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<tbody>
<tr>
<td>pH</td>
<td>s.u</td>
<td>6.1</td>
<td>7.76</td>
</tr>
<tr>
<td>Sulfate</td>
<td>mg/l (tot)</td>
<td>1300</td>
<td>162</td>
</tr>
<tr>
<td>Calcium</td>
<td>mg/l (diss)</td>
<td>412</td>
<td>64.1</td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg/l (diss)</td>
<td>164</td>
<td>21.6</td>
</tr>
<tr>
<td>Iron</td>
<td>mg/l (diss)</td>
<td>5.5</td>
<td>&lt;.25</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/l (diss)</td>
<td>7.1</td>
<td>0.091</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/l (diss)</td>
<td>11</td>
<td>0.044</td>
</tr>
<tr>
<td>Lead</td>
<td>mg/l (diss)</td>
<td>0.004</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Nickel</td>
<td>mg/l (diss)</td>
<td>0.3</td>
<td>0.004</td>
</tr>
</tbody>
</table>