Presentation Outline

- Placement data
- Stability
  - Compaction
  - Inspections
  - Slope monitoring
- Water level data
- Precipitation data
- Water quality at internal monitoring sites
- ABA data
- General site management
Table 3.1 Site 23 Placement Data

<table>
<thead>
<tr>
<th>Date</th>
<th>Surveyed (cy)</th>
<th>Surveyed (tons)</th>
<th>Hauled To Tails from Site 23 (tons)</th>
<th>From UG Truck Counts (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monthly</td>
<td>Monthly</td>
<td>Monthly</td>
<td>Class 1</td>
</tr>
<tr>
<td>1/31/2012</td>
<td>6,487</td>
<td>10,981</td>
<td>5,648</td>
<td>16,831</td>
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<tr>
<td>2/29/2012</td>
<td>8,517</td>
<td>14,417</td>
<td>4,600</td>
<td>12,603</td>
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<tr>
<td>3/29/2012</td>
<td>3,932</td>
<td>6,656</td>
<td>4,724</td>
<td>16,393</td>
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<td>4/30/2012</td>
<td>7,806</td>
<td>13,214</td>
<td>1,590</td>
<td>17,120</td>
</tr>
<tr>
<td>5/31/2012</td>
<td>6,053</td>
<td>10,246</td>
<td>2,408</td>
<td>11,183</td>
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<tr>
<td>6/28/2012</td>
<td>6,543</td>
<td>11,076</td>
<td>5,416</td>
<td>7,496</td>
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<tr>
<td>7/31/2012</td>
<td>6,513</td>
<td>11,025</td>
<td>6,635</td>
<td>7,136</td>
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<tr>
<td>8/30/2012</td>
<td>4,414</td>
<td>7,472</td>
<td>3,180</td>
<td>13,092</td>
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<tr>
<td>9/30/2012</td>
<td>5,809</td>
<td>9,833</td>
<td>4,670</td>
<td>10,530</td>
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<tr>
<td>10/30/2012</td>
<td>5,359</td>
<td>9,072</td>
<td>2,485</td>
<td>12,150</td>
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<tr>
<td>11/28/2012</td>
<td>5,759</td>
<td>113,741</td>
<td>2,639</td>
<td>13,920</td>
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<tr>
<td>12/31/2012</td>
<td>5,565</td>
<td>123,161</td>
<td>1,834</td>
<td>10,680</td>
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<tr>
<td>TOTAL</td>
<td>72,757</td>
<td>123,161</td>
<td>45,829</td>
<td>149,134</td>
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</tbody>
</table>

Current volume ~1,222,457 tons
Site 23/D Stability

- **Compaction**
  - Method specification includes spreading in less than 24” lifts with at least one pass with a bulldozer and four passes with a 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 6 USFS and 3 ADEC/ADNR inspections during 2012
Site 23/D Stability

- Slope monitoring
  - 13 survey hubs monitored with GPS during 2012
    - No large movements were identified
  - Inclinometer readings
    - IN-23-05-01 shows a minor creep at 79.3’ (~1.7mm/yr)
    - IN-23-10-01 shows no movement since installation in 2010
    - IN-23-10-02 shows a minor creep at 114.4’ (~1.1 mm/yr)
    - IN-23-10-08 shows a movement zone from 125.8’ to 135.8’ with the maximum movement at 131.8’ (1.5 mm/yr)
    - IN-T-10-21 shows slight movement of less than 0.5 mm at 47.7’, 67.7’, and 1 mm at 79.7’
    - IN-920-10-05 shows slight movement of less than 0.75 mm at 12.7’
    - IN-1350-10-01 shows a minor creep at 83.5’ (~3.2 mm)
Figure 3.30 IN-23-05-01
Incremental Displacement

Notes:
Zero reference is top of casing, at 4.7 ft above ground surface.
Top section of casing/damage joint replaced in July 2011.
Bias-shift correction by penning data sets at 150 ft depth (A, B axis).
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
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>-4.39</td>
<td>5.97</td>
</tr>
<tr>
<td>February</td>
<td>0.01</td>
<td>2.67</td>
</tr>
<tr>
<td>March</td>
<td>-0.55</td>
<td>2.39</td>
</tr>
<tr>
<td>April</td>
<td>3.89</td>
<td>1.75</td>
</tr>
<tr>
<td>May</td>
<td>5.05</td>
<td>5.23</td>
</tr>
<tr>
<td>June</td>
<td>9.60</td>
<td>5.20</td>
</tr>
<tr>
<td>July</td>
<td>11.26</td>
<td>3.92</td>
</tr>
<tr>
<td>August</td>
<td>11.75</td>
<td>6.48</td>
</tr>
<tr>
<td>September</td>
<td>8.56</td>
<td>10.99</td>
</tr>
<tr>
<td>October</td>
<td>2.43</td>
<td>4.34</td>
</tr>
<tr>
<td>November</td>
<td>-0.40</td>
<td>3.99</td>
</tr>
<tr>
<td>December</td>
<td>-4.88</td>
<td>2.67</td>
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<tr>
<td><strong>2012</strong></td>
<td><strong>3.53</strong></td>
<td><strong>55.6</strong></td>
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Internal site waters are captured, treated, and discharged per HGCMC’s NPDES/APDES permit.

- pH values are between 6.3 and 8.0 (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
Site 23/D Finger Drains
Figure 3.14a – pH
Site 23/D Finger Drains
Figure 3.17a – Conductivity
Site 23/D Finger Drains
Figure 3.20a – Dissolved Zinc
Site 23/D Wells and D Pond Figure 3.14b – pH
Site 23/D Wells and D Pond
Figure 3.17b – Conductivity
Site 23/D Wells and D Pond
Figure 3.20b – Dissolved Zinc

(6/25/09, 980)
Figure 3.28 ABA Data
Underground Rib Sampling
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
  - D Pond berm
Cover Design

Growth Medium
Capillary Break
Barrier Layer
Capillary Break

2 meters
Site 23 Cover Excavation
Site 23 Cover Excavation

Growth Medium

Capillary Break

Barrier Layer

Capillary Break
• 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

• Trench flow was about 70-80% upper capillary break and 20-30% growth medium. 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

• 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

• OSU vegetation assessment recommends allowing development of native spruce/hemlock vegetation with windthrow to promote nutrient mixing and minimize erosion
Site E Removal Activities 2011
960 Site Waste Rock Removal
## 960 Site Waste Rock Removal

<table>
<thead>
<tr>
<th>Site 347</th>
<th>Before Removal</th>
<th>After Removal</th>
<th>After Removal</th>
<th>After Removal</th>
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<tbody>
<tr>
<td>Parameter</td>
<td>Unit</td>
<td>9/12/95</td>
<td>9/28/06</td>
<td>8/17/09</td>
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<tr>
<td>pH</td>
<td>st. units</td>
<td>6.1</td>
<td>7.6</td>
<td>7.5</td>
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<tr>
<td>Sulfate</td>
<td>mg/l (tot)</td>
<td>1300</td>
<td>161</td>
<td>230</td>
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<tr>
<td>Calcium</td>
<td>mg/l (diss)</td>
<td>412</td>
<td>64</td>
<td>102</td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg/l (diss)</td>
<td>164</td>
<td>21</td>
<td>28</td>
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<tr>
<td>Iron</td>
<td>mg/l (diss)</td>
<td>5.5</td>
<td>0.2</td>
<td>ND</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/l (diss)</td>
<td>7.1</td>
<td>0.4</td>
<td>0.272</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/l (diss)</td>
<td>11</td>
<td>0.1</td>
<td>0.054</td>
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<tr>
<td>Lead</td>
<td>mg/l (diss)</td>
<td>0.004</td>
<td>ND</td>
<td>0.00008</td>
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<tr>
<td>Nickel</td>
<td>mg/l (diss)</td>
<td>0.3</td>
<td>0.005</td>
<td>0.007</td>
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1350 Removal Activities
1350 Removal Activities