Soil-Bentonite Cutoff Wall
Through Dense Alluvium
with Boulders into Bedrock,
McCook Reservoir

Tri-Services Infra-Structure Conference
2-4 August 2005
(St. Louis, MO)

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Outline

- Reason for Cutoff Wall
- Test Section
- Demonstration Section
- Verification
- Lessons Learned
Reservoir Plan Schematic

Existing Vulcan Quarry

Des Plaines River

I-55

Sanitary & Ship Canal

Lagoons

1

2
Historic River Channel
Canalside Cross-Section

Descriptive Labels:
- **Canal Water Level (El. 0')**
- **Reservoir High Water Level (El. -30')**

**Layer Descriptions:**
- **FILL (CL, SP, GW-GM)**: Wt: 130, Cohesion: 1500
- **SILTY CLAY to CLAYEY SILT w/sand (CL-ML)**: Wt: 130, Cohesion: 2000
- **SLURRY**: Wt: 120, Cohesion: 0, Phi: 0.1
- **Silty SAND (SM)**: Wt: 130, Cohesion: 0, Phi: 34
- **DOLOMITE**: Wt: 160, Cohesion: 0, Phi: 45
- **CLAYEY SILT to silty SAND (SM, ML)**: Wt: 130, Cohesion: 0, Phi: 32
Slope Erosion
Test Section

- Construction – July-Aug 2000
- 4-sided Box (50’ x 50’)
- Pump Test
Excavator
Boulders
## Hardpan

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>USCS Classification</th>
<th>Moisture Content $w_c%$</th>
<th>Dry Density $\gamma_d$</th>
<th>Specific Gravity $G_s$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clayey Silt</td>
<td>ML</td>
<td>9.8</td>
<td>133.3</td>
<td>2.75</td>
</tr>
</tbody>
</table>
Demonstration Section & Initial Wall Construction

- Modified Contract to Demonstrate Alternate Method to Penetrate Hardpan and Bedrock

- Conducted Investigation of Completed Section

- Developed More Stringent & Intensive QA Inspection Program
Chisel
Initial Wall Construction
Initial Wall Construction
Investigation
Probing for Cutoff Wall
Backfill Sampling
Cutoff Wall Construction

Test Section (Aug 2000)

Initial Production Section (Nov 2001)

Demonstration Section (Jul 2001)

Crew #1 (Mar 2002 – Aug 2002)

Crew #2 (Apr 2002 – Nov 2002)

Crew #3 (Jun 2002 – Nov 2002)

Cutoff Wall Construction

- Ground Surface
- Bentonite Slurry
- Soil-Bentonite Backfill
- Bedrock Key
- Hardpan Surface
- Bedrock Surface
Cutoff Wall Construction
Cutoff Wall Construction
Cutoff Wall Construction
QA/QC Verification

- Depth Measurements During Excavation
- Bedrock Key Verification
- Post-Construction Depth Measurements
Depth Measurements
Bedrock Key Verification
Depth Verification
Wall Profile

Northside
(Station 00+00 to 33+50)

East End
(Station 33+50 to 42+00)

Southside
(Station 42+00 to 74+45)

ELEVATION (CCD)

STATION

Groundsurface
Excavator Refusal
Begin Chisel (hardpan)
Top of Bedrock
Bottom of Cutoff Wall
GeoProbe
## Construction Summary

<table>
<thead>
<tr>
<th></th>
<th>Estimated (Square Feet)</th>
<th>Actual (Square Feet)</th>
<th>Method</th>
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</thead>
<tbody>
<tr>
<td>Trench @ $6.25/sf</td>
<td>263,000</td>
<td>182,706</td>
<td>w/Excavator</td>
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<tr>
<td>Trench @ $48.42/sf</td>
<td>14,880</td>
<td>145,375</td>
<td>w/Chisel</td>
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<tr>
<td>Bedrock Key @ $48.42/sf</td>
<td>7,440</td>
<td>7,271</td>
<td>w/Chisel</td>
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<tr>
<td>Total</td>
<td>285,320</td>
<td>335,352</td>
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</table>
Lessons Learned

- Ensure Thorough Site Investigations
- Cutoff Walls MUST be keyed into Underlying Layer for Seepage Control, VERIFY
- Subsurface Construction Requires a High Level of QA/QC, especially at Start-Up
- Keep Close Coordination between Design and Construction
- Perform a Test Section
Stage 1 Cutoff Wall 7440 feet (constructed)

Stage 2 Cutoff Wall 7640 feet (in final design)