Belt-The Creek That Coal Killed
Belt Water Treatment Plant

Bill Snoddy, DEQ
Project Manager

Colin McCoy, P.E.
Tetra Tech, Inc.
John K. Castner
Historical Coal Mining and Coking

1894 – 1913
7.5 millions tons of coal
3 percent sulfur - pyrite
Coke Oven Flats Prior to 1980s Reclamation
Belt Overview

Lewis Coulee

Brodie Mine

Coke Oven Flats

Anaconda Discharge

French Coulee Discharge

09/07/2012
Belt Creek Looking North
Belt Creek Upstream of Mine Discharges

Water sampling indicates DEQ-7 water quality is met immediately upstream of the mine discharges
French Coulee Drain
Anaconda Mine, French Coulee, and Coke Oven Flats Drainage Flowing into Belt Creek
Belt Swimming Hole
Plan C

Belt Water Treatment Plant
The Four Major Initial Design Considerations
1. Determine Treatment Type
2. Determine Plant Location
3. Determine Sludge Disposal
4. Design Basis
Treatment Type

- Contaminants of Concern (exceeded DEQ-7):
  - Aluminum (206 mg/L)
  - Arsenic
  - Beryllium
  - Cadmium
  - Copper
  - Iron (315 mg/L)
  - Thallium
  - Zinc
  - pH = 2.8

- Going through the NCP motions, the EECA evaluated:
  - Water-Powered CaO Addition (not effective)
  - Single Stage Hydrated Lime $
  - Two-Stage Hydrated Lime $$
  - Nanofiltration $$$$$$$$

Preferred Alternative: Single Stage Hydrated Lime
Plant Location

Two Options:
1. On unconsolidated coal waste below the adit
2. On DEQ property 250 feet above the adit

Obtained LiDAR data to cover large area
Plant Location Options

UNCONSOLIDATED COAL WASTE

250 FT ABOVE MINE ADIT

MINE ADIT
Three Options Evaluated:
1. Sludge Press and Landfill Disposal
2. Drying ponds
3. Injection into the Underground Mine Workings

Preferred Alternative: Injection into the Underground Mine Workings Mine Pool
Underground Evaluations

Step 1: Borings into mine workings (Really Stressful)
  ▪ Successful at 3-4/10 boring locations
Step 2: Downhole Camera (Really Cool)
Step 3: Initial 1-week pump test
  *Weird Results at adit discharge – increased flow, then no effect*
Step 4: 1 month 500gpm pump test (20+ million gallons)
  *No effect on adit flow*
Boring Locations and Mine Pool
200 GPM 1 Week Pump Test

![Graph of Pump Test Data]

**Figure 4**

**200 gpm Pump Test Drawdown vs Time**

- **T10 Regression**: Intercept: -0.0024, Adjusted R^2: 0.6277, Slope: -0.0001, Units: drawdown
- **T20 Regression**: Intercept: -0.0024, Adjusted R^2: 0.6277, Slope: -0.0001, Units: drawdown
- **T30 Regression**: Intercept: -0.0024, Adjusted R^2: 0.6277, Slope: -0.0001, Units: drawdown

**Legend**
- **T10**: Blue
- **T20**: Blue
- **T30**: Blue
- **T40**: Blue
- **T50**: Blue
- **T60**: Blue

**Notes**
- Time in Hours (relative to start of pumping)
- Drawdown Regression
500 GPM 1 Month Pump Test

![Graph showing 500 GPM 1 Month Pump Test data with time in hours (relative to start of pumping) and drawdown vs. time.]

**Figure 3**

<table>
<thead>
<tr>
<th>500 gpm Pump Test Drawdown vs Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>h</strong> - Head at outlet of pumping</td>
</tr>
<tr>
<td><strong>T</strong> Regression</td>
</tr>
<tr>
<td>Adjusted Regression 0.6702</td>
</tr>
<tr>
<td>Slope of 0.6702</td>
</tr>
</tbody>
</table>
New Direction

Step 5: Drill near new plant location (really stressful.....again!)
  ▪ Hit workings 2/4 borings (Whew.....)

New Plan: Try injection near the plant into dry workings.
Plan B: Longer pipeline to mine pool
Plan C: Drying ponds?
Dry Underground Workings – New Injection Site
Design Basis

- Maximum Predicted Flow: 225 gpm
- Single treatment train with dual outdoor clarifiers
- Design Basis for collection, process equipment and storage ponds: 225 gpm
- Design Basis for Clarifiers: 165 gpm (75\textsuperscript{th} percentile)
- Sludge injection 500 feet from plant
Process Design

Untreated MIW From Anaconda Mine & French Coulee Adits

Influent EQ

Densification Tank

Reaction Tank

Clarifier

Effluent Tank

Treated Effluent To Belt Creek

Recycled Sludge

Emergency Retention Pond

Emergency Treatment Pond

NaOH

Lime Slurry

Polymer

Treated Effluent To Belt Creek

Waste Sludge Return to Mine
Plant Footprint

- Process Area Features
  - Clarifiers outside reduce building footprint
  - Elevated walkways to access tanks and clarifiers
  - Staging and storage
  - Potential future expansion
    - Zeolite treatment
    - Oxidation
  - Crane rail system for equipment maintenance

- Administrative Area Features
  - Shower
  - 2 restrooms
  - Meeting Room
  - Break Room
  - Control Room
Plant Cross Section
Currently Considering:
● Caustic dosing and settling pond below adit
● Pond with 2-week retention time near the plant
● Dual Clarifiers
Plant Layout
Questions?
Fun Fact

Tom Henderson, besides being an excellent human and great hydrogeologist, was the base guitarist for a 1990’s grunge band from Denver, Colorado that opened for Green Day.