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Blacklick Creek Treatment Facility

Heather Trexler, PG

West Virginia Mine Drainage Task Force Symposium & 15th International Mine Water Association Congress

April 23, 2023

WVTF IMWA 2024

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We are the 27,000 faces of Tetra Tech. We are dedicated problem-solvers and innovators from 60 disciplines collaborating on innovative projects worldwide.

Outline

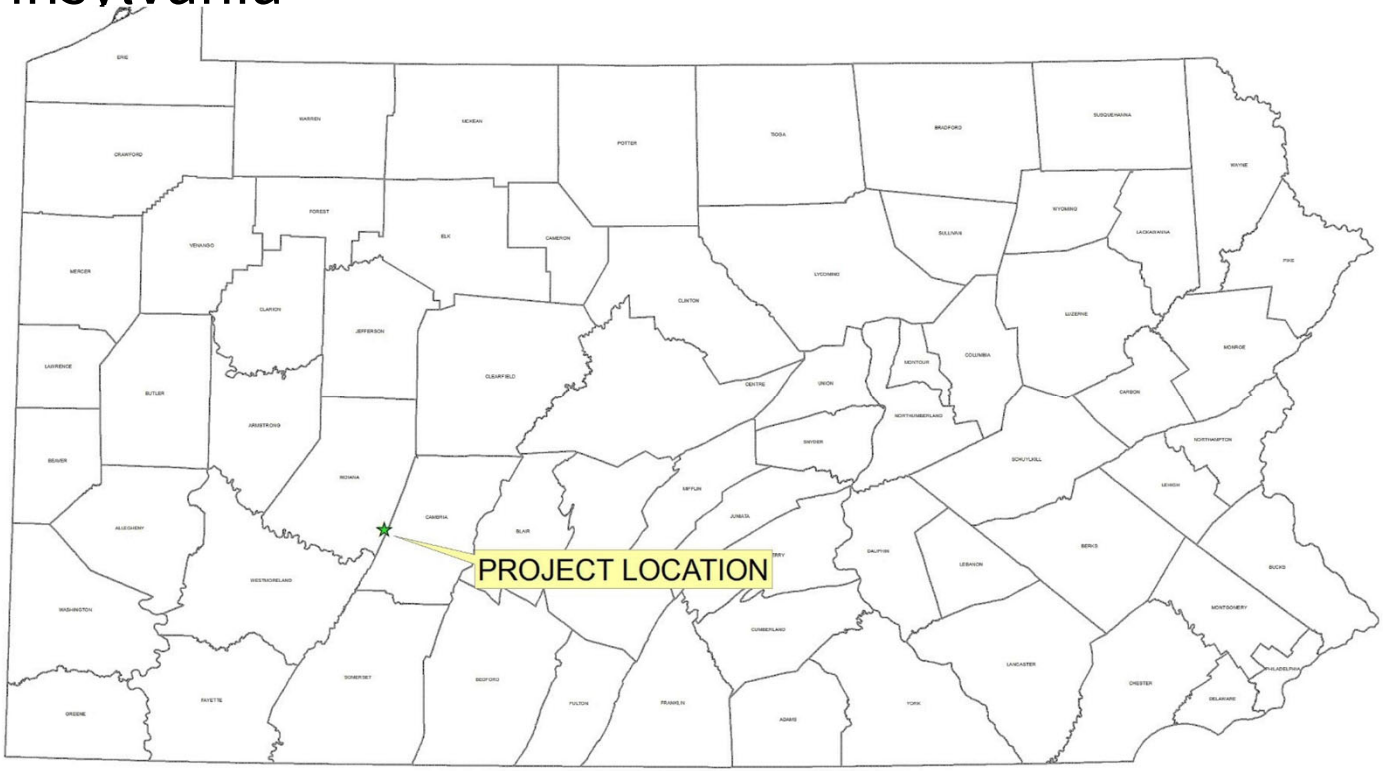
- Project objectives
- General chemistry
- Design
- Permitting
- Sludge disposal
- Mine pool management
- Additional reviews
- Construction

Project Team

OSMRE	• Project funding
PADEP BAMR	• Owner • Operator
Tetra Tech, Inc	• Design • Permitting • Construction assistance
Sci-Tek Consultants, Inc	• Subsurface exploration, geotechnical recommendations
HRI, Inc	• Construction

Project Location

- Acid mine drainage (AMD) plant located in Buffington Township, Indiana County, Pennsylvania



Project Milestones

- Feasibility reviews of collection and conveyance to treat multiple discharges and multi-year discharge flow monitoring and sample collection
  - 2015 - 2017
- Design and permitting
  - 2018 - 2021
- Construction
  - 2022 - anticipated wet commissioning June of 2024

Goals of the Project

- Eliminate three uncontrolled discharges of untreated mine water within Blacklick Creek Watershed.
- Restore North Branch Blacklick Creek, main stem of Blacklick Creek to make it a viable spot for fishery sport.
- Treat mine pool water to meet effluent standards.
- Lower and maintain Wehrum and Vinton No. 6 mine pools levels to provide storage capacity for 30 days of maximum inflow.
- Provide for in mine storage of injected mine water treatment sludge.

Mine Discharges

Commercial 16 discharge

Wehrum shaft discharge

Vinton No. 6 borehole discharge

Visible Impacts to Blacklick Creek

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Pollution Loadings

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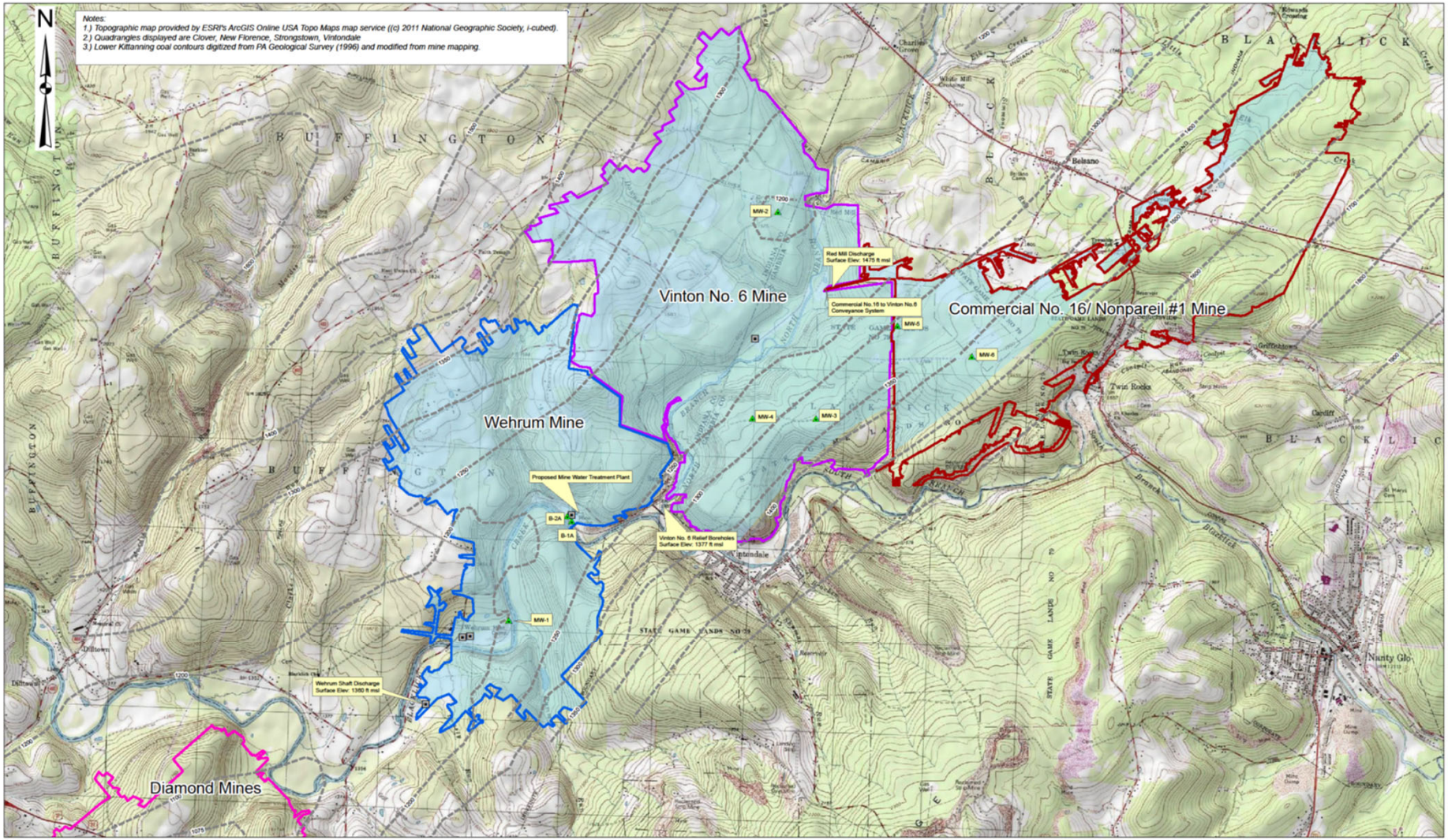
- Pollution loadings that are anticipated to be removed by treatment of AMD discharges

Parameter	Pollution Loading (lb/day)	Pollution Loading (kg/day)
Hot acidity	8,778	3,980
Total aluminum	260	117
Total iron	3,998	1,813
Total manganese	60	27



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pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Legend
- PADEP_MW_2016
- shafts
- Approx. Extent of Mine Pool
- Lower Kittanning Bottom of Coal Elevation

Date:	Project No.:	Scale:
January 12, 2017	112C07166	1 inch = 1,500 feet
Drawn by: HAT	Checked by: TAG	0 1,000 2,000 4,000 Feet

BUREAU OF CONSERVATION AND RESTORATION
BLACKLICK CREEK TREATMENT FACILITY
BLACKLICK, BUFFINGTON, & EAST WHEATFIELD TOWNSHIPS CAMBRIA & INDIANA COUNTIES

Task No. AMD 32(2246)101.1

PROJECT LOCATION MAP

FIGURE B-1

Path: S:\Tom Gray Files - Tom Gray\PADEP BOM Programs\Blacklick Creek AMD Facility 112C07166\GIS\Blacklick Project site.mxd

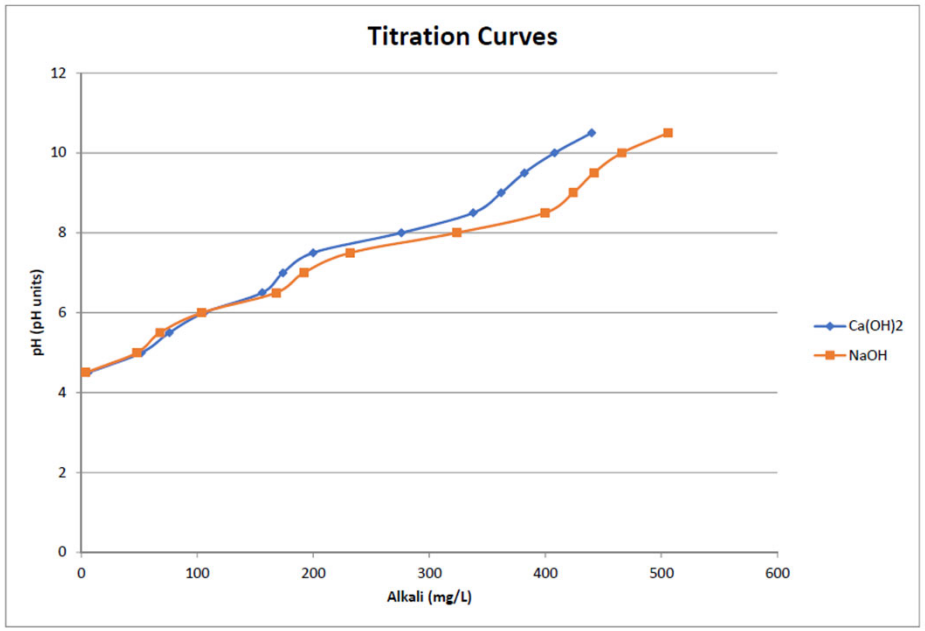
General Chemistry

Parameter		MCS	Historical Average	90th % of Historical Data
Laboratory pH	S.U.	4.4	4.3	4.8
Hot Acidity (as $CaCO_3$)	mg/L	552	242	313
Tot. Alkalinity (as $CaCO_3$)	mg/L	0	8.2	19
Diss. Alkalinity (as $CaCO_3$)	mg/L	0	--	--
Total Inorganic Carbon (field sample)	mg/L	21.8	33.6	--
Tot. Iron	mg/L	258.1	90.2	132
Diss. Iron	mg/L	254.3	90.2	
Ferrous Iron	mg/L	140	90.2	134
Tot. Aluminum	mg/L	12	9.2	11.8
Diss. Aluminum	mg/L	11.4	--	--
Tot. Manganese	mg/L	2.65	1.8	2.1
Diss. Manganese	mg/L	2.61	--	--

- MCS – Master Composite Sample of proportional flow of 3 discharges
- Historical data includes 60-70 samples

Treatability Testing

FIGURE 2
TITRATION CURVES FOR LIME SLURRY AND CAUSTIC SODA SOLUTION



- Provide a characterization of a volumetrically proportioned Master Composite Sample (MCS) expected to approximate the chemistry of the influent
- Develop titration curve for the MCS with lime slurry
- Develop mass balance data
- Evaluate projected effluent quality/compliance status to be expected from lime neutralization to a pH setpoint of approximately 8.3 S.U.
- Determine if adequate manganese removal occurs at a slightly alkaline setpoint, or if a high pH is required
- Assessment of whether mechanical pre-aeration appears to be prudent
- Identify a suitable anionic polymer and the approximate operational dose

Effluent Limits

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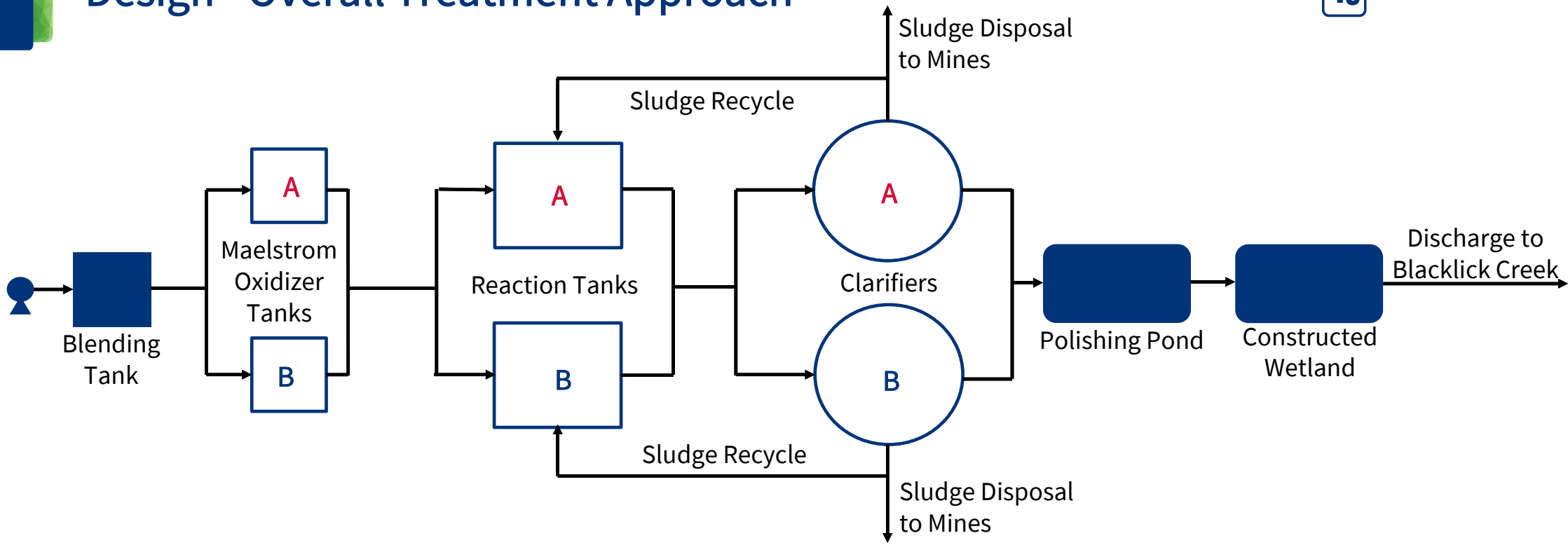
Parameter	30- Day Average	Daily Maximum	Instantaneous Maximum
Total Aluminum (mg/L)	0.5	1.0	1.5
Total Iron (mg/L)	1.5	3.0	5.0
Total Manganese (mg/L)	2.0	4.0	5.0
Total Suspended Solids (mg/L)	35	70	90
pH	Greater than 6.0 S.U, less than 9.0 S.U		
Alkalinity, mg/L as $CaCO_3$	Alkalinity exceeds acidity by 20 mg/L or more		
Hot Acidity, mg/L as $CaCO_3$			

Design - Overall Treatment Approach



- Treatment plant was designed with an average influent flow of 2,800 gpm (10,599 L/min) and a design flow of 5,000 gpm (18,927 L/min).
- Two different process trains for parallel units: A & B.

Overall Treatment Approach

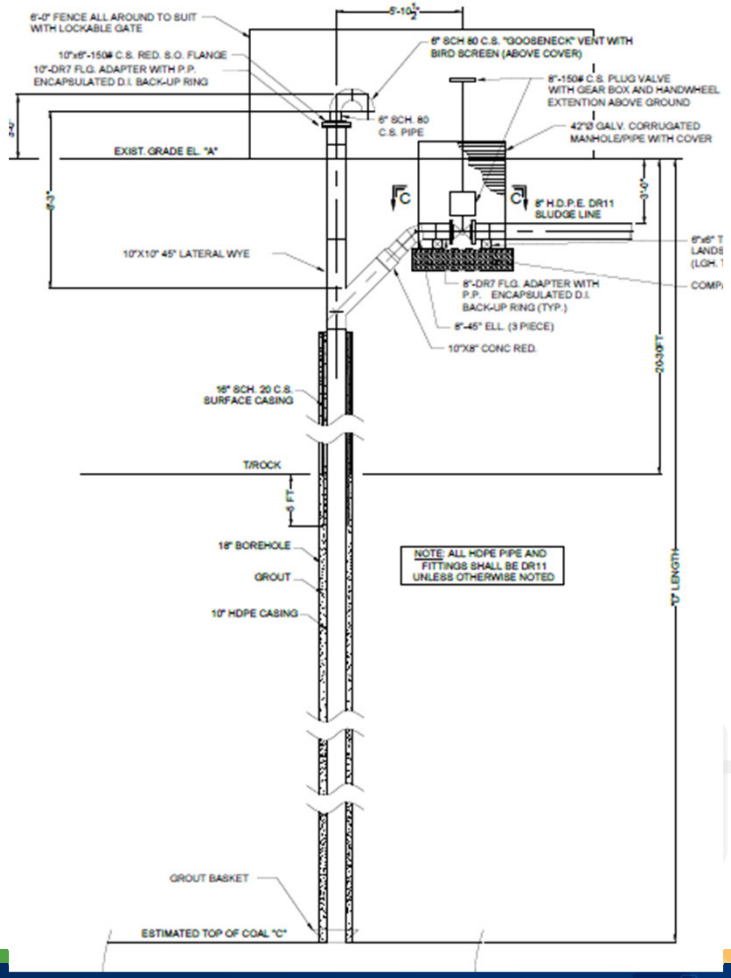
- Single units sized for design influent flowrate of 5,000 gpm plus recycle streams.
  - Blending Tank
  - Polishing Pond
  - Constructed Wetland
- Parallel units sized for average influent flowrate of 2,500 gpm plus recycle streams.
  - Maelstrom Oxidizer Tanks
  - Reaction Tanks
  - Clarifiers

Design – Major Components

- **Maelstrom Oxidizer®** Tanks used to oxidize mine water to absolve TIC from the mine water with the intent to lower the pH of the water
- **Hydrated Lime System** used as neutralization reagent to raise the pH of influent mine water. Dense lime slurry of >30% lime. A pH of 8.0-8.5 to be maintained to facilitate both iron and aluminum removal
- **Flocculating clarifiers** provide for coagulation and flocculation of incoming particulate matter. Includes sludge withdrawal lines and pumps underneath both clarifiers to gather sludge that accumulates at the bottom of the clarifiers
- Sludge will either be recycled back to the reaction tanks or will be injected back into the mines from the bottom of the clarifiers. Sludge recycle will be used to:
  - Increase suspended solids content entering the clarifiers
  - Enhance settling behavior of sludge
  - Recycle any polymer or lime solids stuck in sludge

Sludge Disposal

- To site sludge injection well locations considered access, storage potential, property ownership, pumping distance, surface elevation, and mine workings.
- Exploratory drilling was performed at 2 locations to verify mine conditions at the proposed injection locations.
- The sludge storage volume for the proposed sludge injection wells is estimated to be 12 years for 2 locations.
- Identified future injection locations from main pipeline
  - Sludge storage calculations are based on an injection rate of 2,488 cubic foot per day, 16% solids.
  - The estimated storage volume is based on an assumed void factor of 60 percent of the total void space.



Permitting

- Rare, threatened, endangered species reviews
- Cultural and archaeological reviews
- Erosion and Sediment Control
- Access driveways
- Building permit
- Impacts to wetlands and streams
- Structures within 100-year floodplain
- Connection to municipal water and sewer
- Extension of 3-phase power line

Mine Pool Management

- Stage storage curves developed to evaluate total pool volumes and estimate hydraulic head reduction (drawdown) and fluid storage needed for a 30-day storage reserve during peak inflow periods
- The Wehrum mine pool holds 960 million gallons and its 30-day storage buffer is estimated at 50 million gallons
- The Vinton mine pool holds 900 million gallons and its 30-day storage buffer is estimated at 135 million gallons.
- The extraction well pumps for these mine pools will be equipped with variable speed drives, providing additional operational flexibility

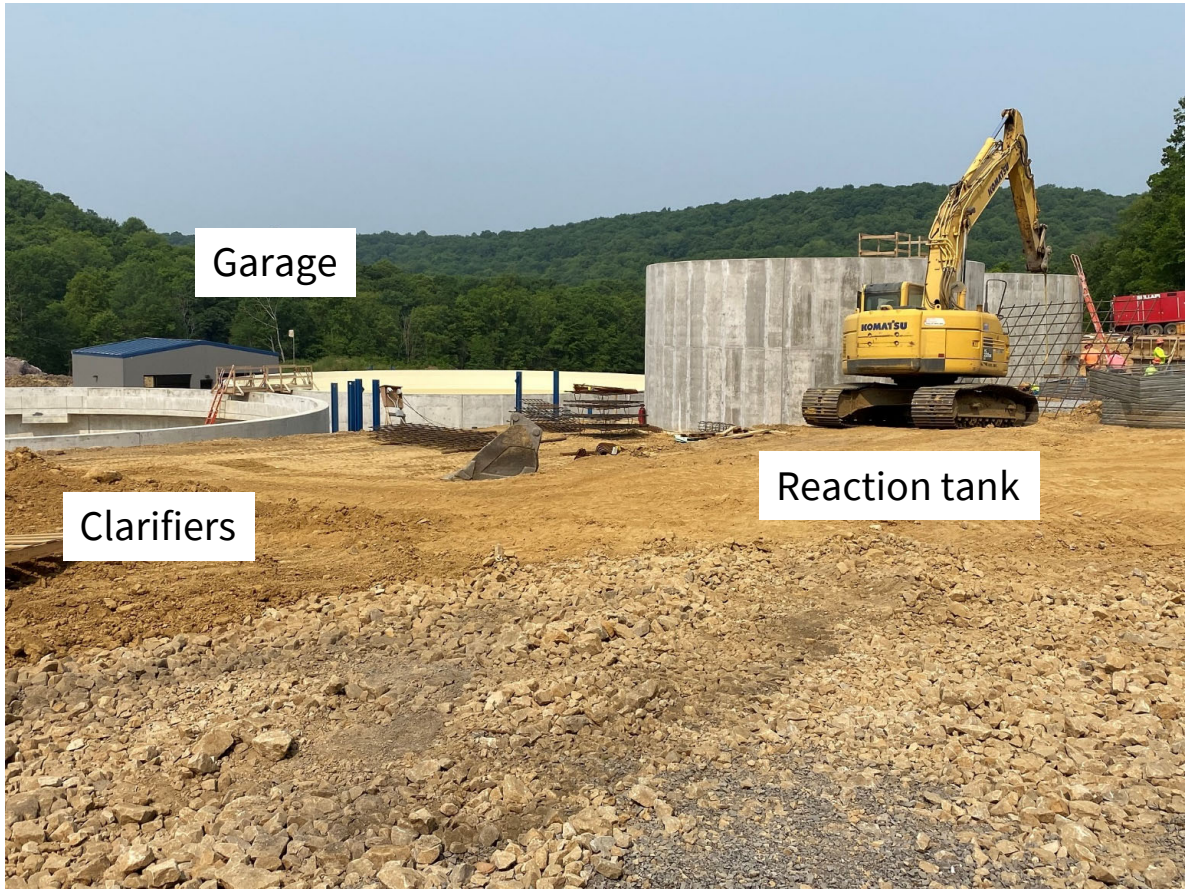
Additional Reviews

- Domestic/Residential Water Supplies
  - The lowering of the Wehrum and Vinton No.6 mine pools has the potential to affect the hydrologic balance within the area
  - Based on field survey and water sampling, it is not expected that the lowering of the mine pools or injection of the treated sludge will affect the supplies inventoried since the bottom of the wells are well above the mine pools and sample data collected from the water supplies do not indicate influence by the mine pools.
- Subsidence at treatment plant
  - Treatment plant overlies mine workings, 150-200 feet below ground
  - Concluded that all buildings and tanks are located above areas where subsidence is not expected
    - A shallow, stormwater infiltration basin, and parts of the polishing wetland and off-spec pond are located above potential subsidence zones
    - Mine void grouting proposed for slope entry and shafts

Construction – October 2022

Construction – November 2022

Construction – June 2023



Construction - September 2023

Construction – October 2023

Construction April 2024

Construction - April 2024

Construction - April 2024

Thank You!

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