

AMD Treatment in the Cheat River & Deckers Creek Watersheds Passive Approach

Wv Mine Drainage Taskforce Symposium March, 2016

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BioMost, Inc.
Mining & Reclamation Services

Specializing in Mine Drainage Treatment
Design • Build • Maintain



Stream Restoration Inc.



OVERVIEW

- ! Typical Design Approach
- ! Case Studies of 2 Recent Projects
 - ! Passive Treatment
 - ! Preston County WV
- ! Friends of the Cheat (FOC)
 - ! North Fork Greens Run Railroad Refuse (NFGRR)
 - ! Completed Fall 2015
- ! Friends of Deckers Creek (FODC)
 - ! Slabcamp Tributary PTS
 - ! Completed Fall 2015

Typical Site Approach

- ! Analyze Supplied Data
 - ! Take Confirming Samples
 - ! Site Investigation
 - ! Bucket Tests
- ! Develop Conceptual Plan
- ! Field Verify Design
 - ! Test Pits
- ! Final Design
 - ! Review (OSM)
- ! Permitting
- ! Construction



North Fork Greens Run PTS

- ! WVDEP AML Reclamation
 - ! Refuse, Wet Seals, OLC
- ! Site Significance
 - ! Low pH Iron Removal
 - ! Tiff Hilton



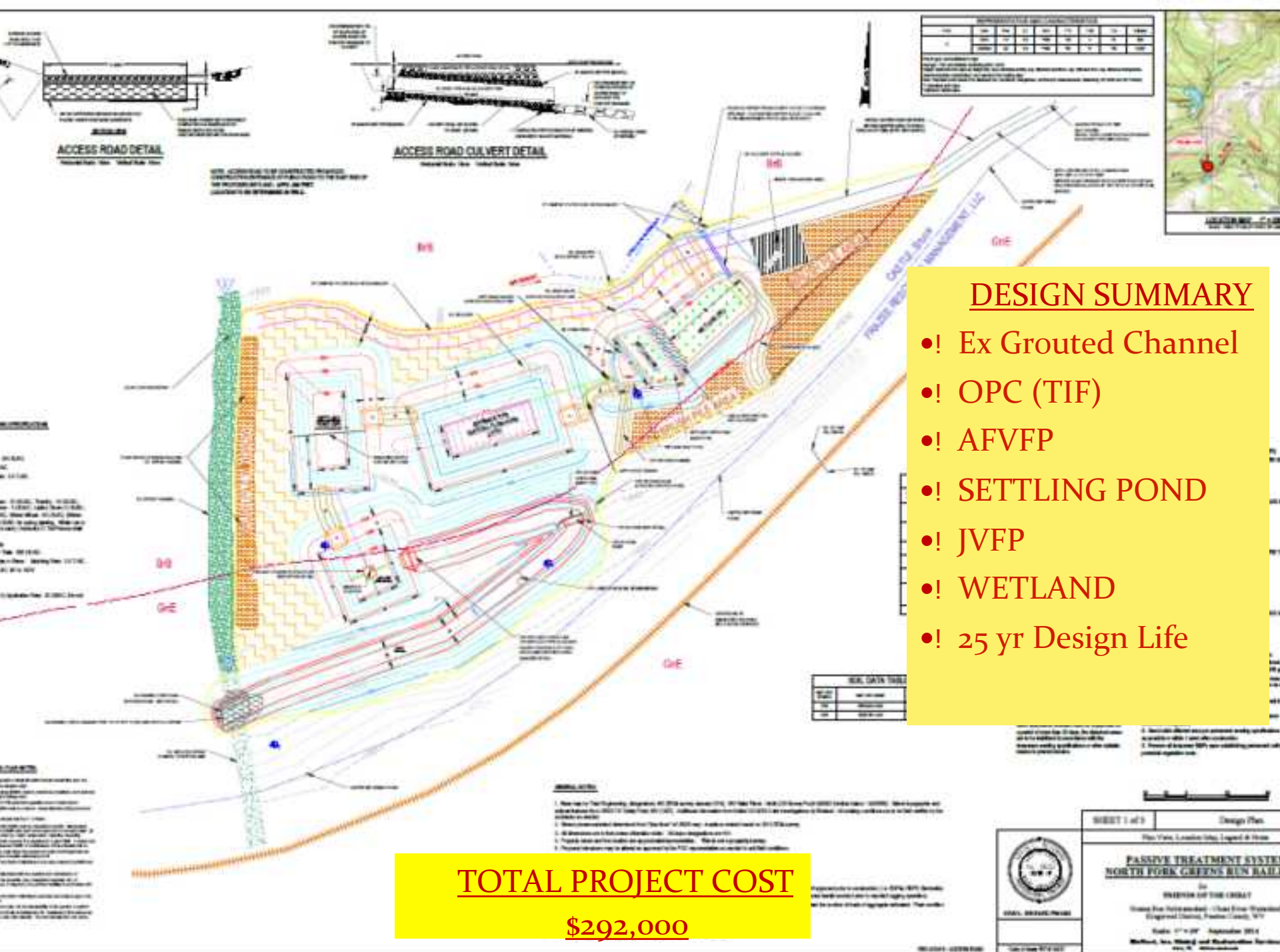
North Fork Greens Run PTS

- ! Passive Treatment Technology
- ! Design Parameters @ System Intake:
 - ! Flow 7 to 29 gpm
 - ! pH 2.9 SU
 - ! Acid *400 mg/L
 - ! T Fe | diss. Fe 104 | 53 mg/L - (@ source 300 + mg/L (Total))
 - ! T Al | diss. Al 61 | 35 mg/L
 - ! T Mn | diss. Mn 4 | 2 mg/L
 - ! Sulfates 2,000 mg/L

*calculated acidity

Contractor: Solid Rock Excavating

- ! Local Wv Company
- ! Easy to Work With
- ! Landowner Relationships
- ! Quality Work Product



OXIDATION PRECIPITATION CHANNEL (OPC / TIF)

- ! Design Channel Bottom
Area 4,300 sq ft
 - ! ~430 ft Long (lined)
- ! Encourage Natural Iron
Precipitation Process
- ! Sheet Flow
 - ! Self Leveling



Iron Removal

- ! Iron Removal
 - ! Top: 106 mg/L Diss. Fe
(1780 mg/L Acid)
 - ! TIF Inlet: 77 mg/L Diss. Fe
(1450 mg/L Acid)
 - ! TIF Outlet: 7.8 mg/L Diss. Fe
(510 mg/L Acid)
- ! ~90% Removal in TIF



AUTO-FLUSHING VERTICAL FLOW POND (AFVFP)

- ! Limestone Only
 - ! 250 Tons
 - ! Retention Time - 8 hrs
- ! Dual Siphons
 - ! High Flow (Mo.# 430)
 - ! Low Flow (Mo.#413)
- ! Target pH ~5.0



SETTLING POND

- ! Solids Settling
 - ! Sludge Storage 25 yr
 - ! ~4,500 sq. ft
- ! Retention Time
 - ! 48 hr
- ! Baffle Curtain
 - ! Windowed



JENNINGS VERTICAL FLOW POND (JVFP)

- ! Spent Mushroom Compost
 - ! 150 CY
- ! Woodchips
 - ! 150 CY
- ! Limestone Aggregate
 - ! AASHTO #57 - 200Tons
 - ! AASHTO #8 - 200 Tons
- ! Projected Alk ~100 mg/L



WETLAND

- ! 2 Tier Treatment Wetland

- ! 10 g/sm/d

- ! ~3,500 sq. ft (~0.08 Ac)

- ! Iron Removal/Storage

- ! ½ Max Iron load

- ! Aeration



OUTCOMES – EFFLUENT PERFORMANCE

LOCATION	DATE	ACID	ALK	FLOW	TFe	TMn	TAI	pH	SO ₄ ⁻²
PRE (end of OLC BMI n=1)	2013	*1,300	0	<5	214	5.6	129	2.7	1,738
PRE (end of OLC FOC n=23)	Pre '13 AVG	*400	0	7	104	3.5	61	2.9	829
POST (System Effluent n=1)	2015	-66.7	84	56.7	0.4	3.5	0.1	7.5	484

All Units are mg/L,
except pH (S.U.),
Flow (gpm)

*Calc. Acid Values



- ! Dents Run (US ACOE) & McIntire PTS - Successfully Uses Passive Treatment Techniques on Water of Similar Quality | Successfully Treating Water for 5+ years

AERIAL SHORTLY AFTER COMPLETION

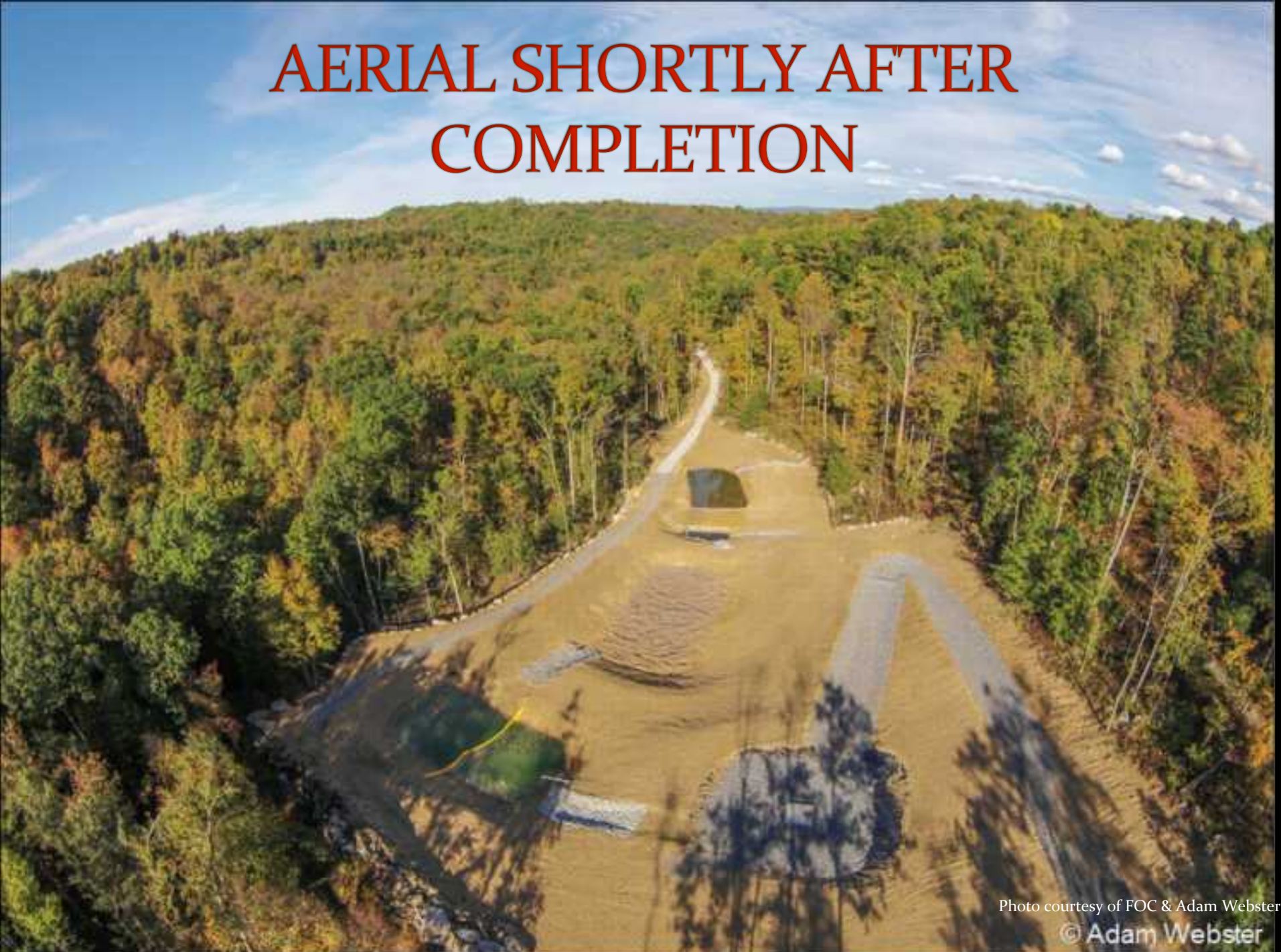


Photo courtesy of FOC & Adam Webster

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SLABCAMP TRIB. PTS

- ! WVDEP AML
 - ! Wet seals & OLCs
- ! Previous In-Stream Limestone Leach Bed (~2007)
 - ! Constructed In-Stream





SLABCAMP TRIB PTS



- ! Passive Treatment Technology

- ! Design Parameters

@ OLC 250

- ! Flow 150 - 200 gpm
- ! pH 3.1 SU
- ! Acid 127 mg/L
- ! Diss. Fe 1 mg/L
- ! Diss. Al 14 mg/L
- ! Diss. Mn 1 mg/L
- ! Sulfates 228 mg/L

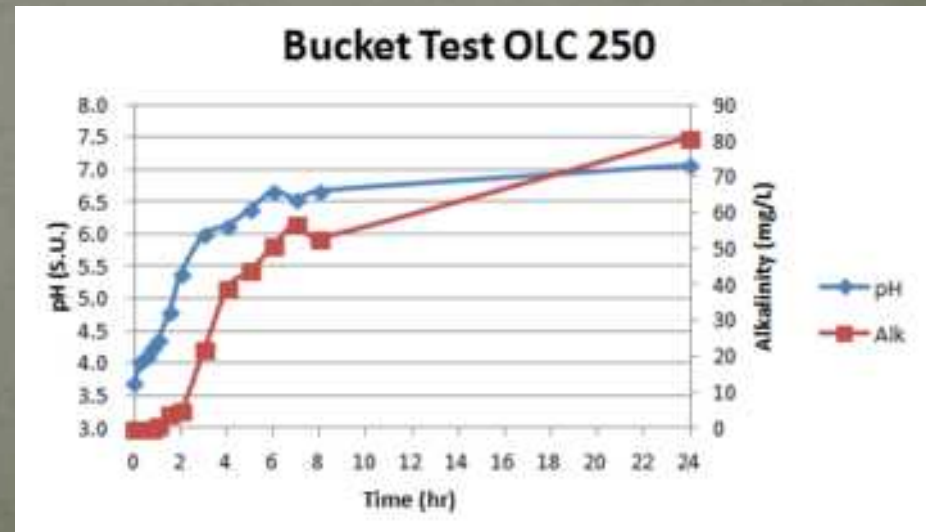
- ! Design Parameters

@ OLC 300

- ! Flow 60 gpm
- ! pH 2.8 SU
- ! Acid 247 mg/L
- ! Diss. Fe 9 mg/L
- ! Diss. Al 23 mg/L
- ! Diss. Mn 1 mg/L
- ! Sulfates 330 mg/L

BUCKET TEST DATA

- ! 24 Hr Test
 - ! pH rapidly increases at first
 - ! (proton attack)
 - ! Alk Gradually increases
- ! Aluminum gone by hr 2 - 3
 - ! (pH ~ 4.5 - 5.0)
- ! Alk was beginning to level off by hr 8



Contractor: Solid Rock Excavating

- ! Local WV Company
- ! Easy to Work With
- ! Landowner Relationships
- ! Quality Work Product



- ! FOREBAY
- ! AFVFP #1
- ! SETTLING POND
- ! AFVFP #2
- ! 25 yr Design Life

\$291,400

FOREBAY

- ! Solids Settling
 - ! ~6,000 sq. ft
- ! Retention Time
 - ! Available Room



AUTO-FLUSHING VERTICAL FLOW POND (AFVFP #1)

- ! Limestone Only
 - ! 3,000 Tons
 - ! Retention Time ~8 hrs
- ! Siphon Driven
 - ! Model #86o
- ! Target pH ~6



SETTLING POND

- ! Solids Settling
 - ! Sludge Storage 25 yr
 - ! ~19,000 sq. ft
- ! Retention Time
 - ! Min 24 Hr +
Sludge Storage
- ! Shaped to Reduce
Short Circuiting



AUTO-FLUSHING VERTICAL FLOW POND (AFVFP #2)

- ! Limestone Only
 - ! 1,000 Tons
 - ! Retention Time ~8 hrs
- ! Siphon Driven
 - ! Model #650
- ! Target pH ~5 - 6



PARTIAL HIGHWALL RECLAMATION



OUTCOMES – EFFLUENT PERFORMANCE (OLC 250)

LOCATION	DATE	ACID	ALK	FLOW	D. Fe	D. Mn	D. Al	pH	SO ₄ ⁻²
PRE (OLC 250)	Pre 2015 AVG	*122	0	150 - 200	1.0	1.0	14.0	3.1	228
POST (Forebay n=1)	2015 snapshot	*96	0		1.3	0.7	9.3	2.9	173
POST (SP#1 -Inlet n=1)	2015 snapshot	*1.3	24		0.2	0.4	<0.01	6.0	175
POST (SP#1 - Effluent) n=1	2015 snapshot	*4.1	86		1.2	0.5	<0.01	6.3	201

All Units are mg/L,
except pH (S.U.),
Flow (gpm)

*Calc. Acid Value



OUTCOMES – EFFLUENT PERFORMANCE (OLC 300)

LOCATION	DATE	ACID	ALK	FLOW	D. Fe	D. Mn	D. Al	pH	SO ₄ ⁻²
PRE (OLC 300)	Pre 2015 AVG	*233	0	60	9.0	1.0	23.0	2.8	330
POST (discharging) n=1	2015 snapshot	*1.4	110	Flush	0.04	0.5	0.08	6.6	374

All Units are mg/L,
except pH (S.U.),
Flow (gpm)

*Calc. Acid Value



SHORTLY AFTER COMPLETION



QUESTIONS

-Thank You-

&

Acknowledgements

Friends of the Cheat

OSM!

Friends of Deckers Creek

Solid Rock Excavating

WV DEP (Martin Christ)

Landowners



Friends of the Cheat

