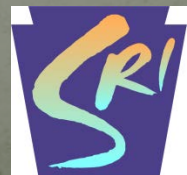


AMD Treatment in the Cheat River & Deckers Creek Watersheds

Passive Approach

ASMR Spokane Washington June, 2016

By: Buck Neely, P.E.; Tim Danehy, QEP; Ryan Mahony; Dan Guy, GIT; Shaun Busler, GISP; Cliff Denholm; Margaret Dunn, P.G.; David Petry; Nick Revetta



Stream Restoration Inc.



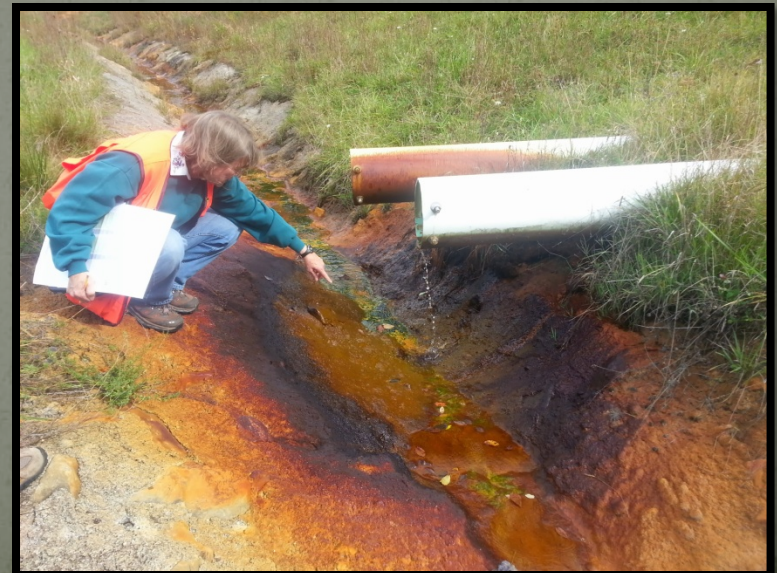
OVERVIEW



- 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



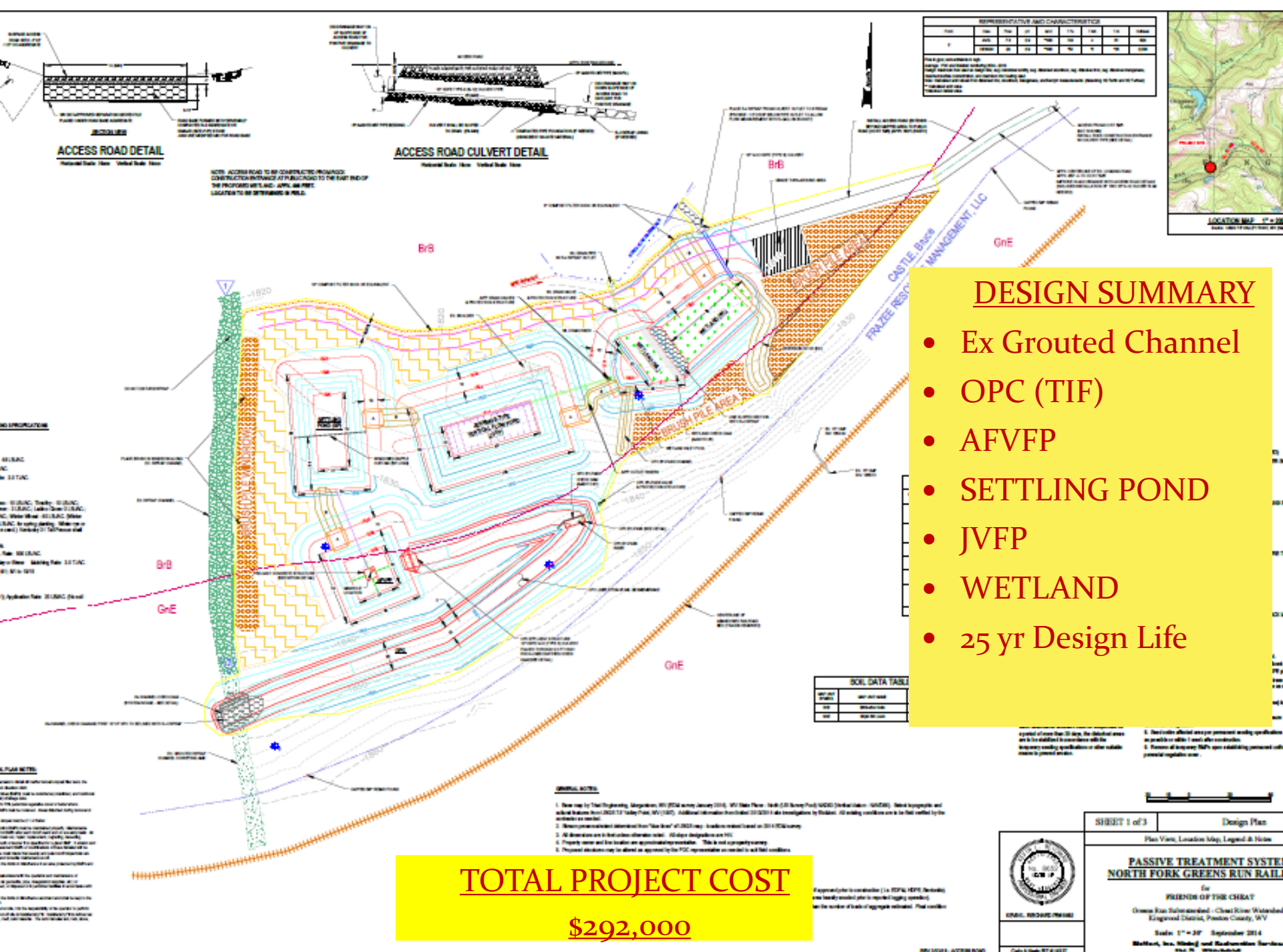
North Fork Greens Run PTS

- 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



- ## DESIGN SUMMARY
- Ex Grouted Channel
 - OPC (TIF)
 - AFVFP
 - SETTLING POND
 - JVFP
 - WETLAND
 - 25 yr Design Life

TOTAL PROJECT COST
\$292,000

SHEET 1 of 3 Design Plan

Plan View, Location Map, Legend & Notes

PASSIVE TREATMENT SYSTEM
NORTH FORK GREENS RUN RAILROAD

for
FRIENDS OF THE CHEAT

Green Run Subwatershed - Cheat River Watershed
 Edgewood District, Boone County, WV

Scale: 1" = 20' September 2014

McMack, Inc. (d/b/a) and Richardson Services
 Morgantown, WV

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



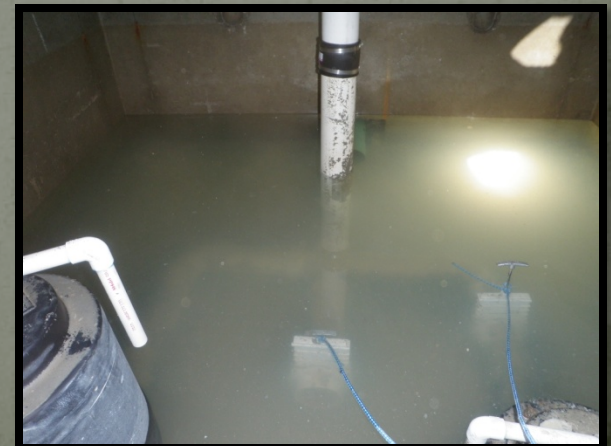
Iron Removal

- 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 - 200 Tons
 - 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

© Adam Webster

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

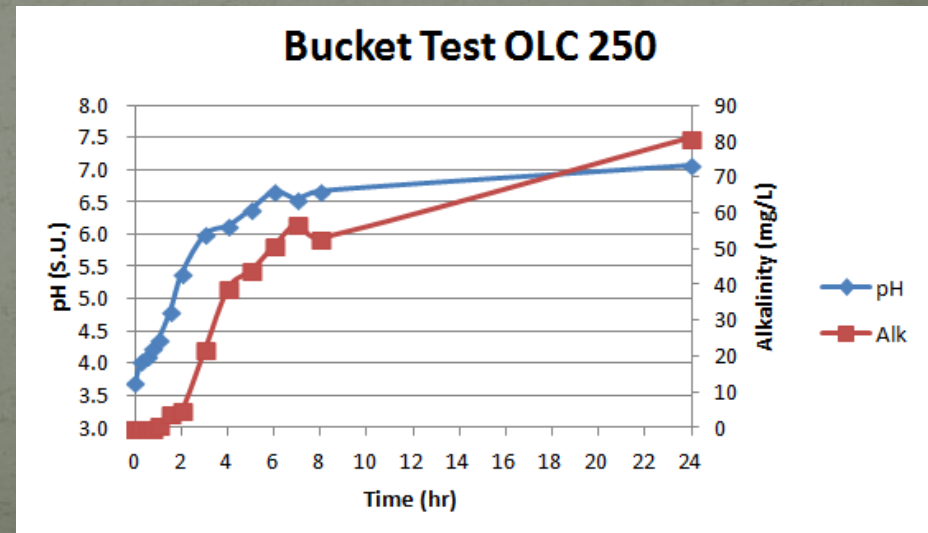
- Flow 60 gpm
- pH 2.8 SU
- Acid 247 mg/L
- Diss. Fe 9 mg/L
- Diss. Al 23 mg/L
- Diss. Mn 1 mg/L
- Sulfates 330 mg/L

WHAT ARE THE ODDS?



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



LEGEND

- OL CONTOUR (BROWN)
- OL CONTOUR (RED)
- OL PROPERTY (BL. NAVY ARMY)
- OL STREAM
- OL WADING SWAMP
- OL WADING SWAMP
- OL SOIL TYPE BOUNDARY
- OL WETLAND BOUNDARY
- OL WETLAND BOUNDARY (APPX)
- OL LIMESTONE SAND DRIP
- OL COUNTY ROAD
- OL PRIVATE (LINE) TRAIL (UNPAVED)
- OL TRAILING
- OL BUILDING
- OL WIND BREAKER
- TEST PIT
- FRONTOUR (BROWN)
- FRONTOUR (RED)
- FRONTAGE TREATMENT COMPONENT
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 M. SYPOLT

TEMPORARY AND PERMANENT FENCE PROJECTIONS

Temporary
 Standard Wood Post-and-Rail
 Post: 4x4 (4x6) (4x8)
 Rail: 2x4 (2x6) (2x8)
 Color: White (Black) (Green)
 Spacing: 10' (12') (15')

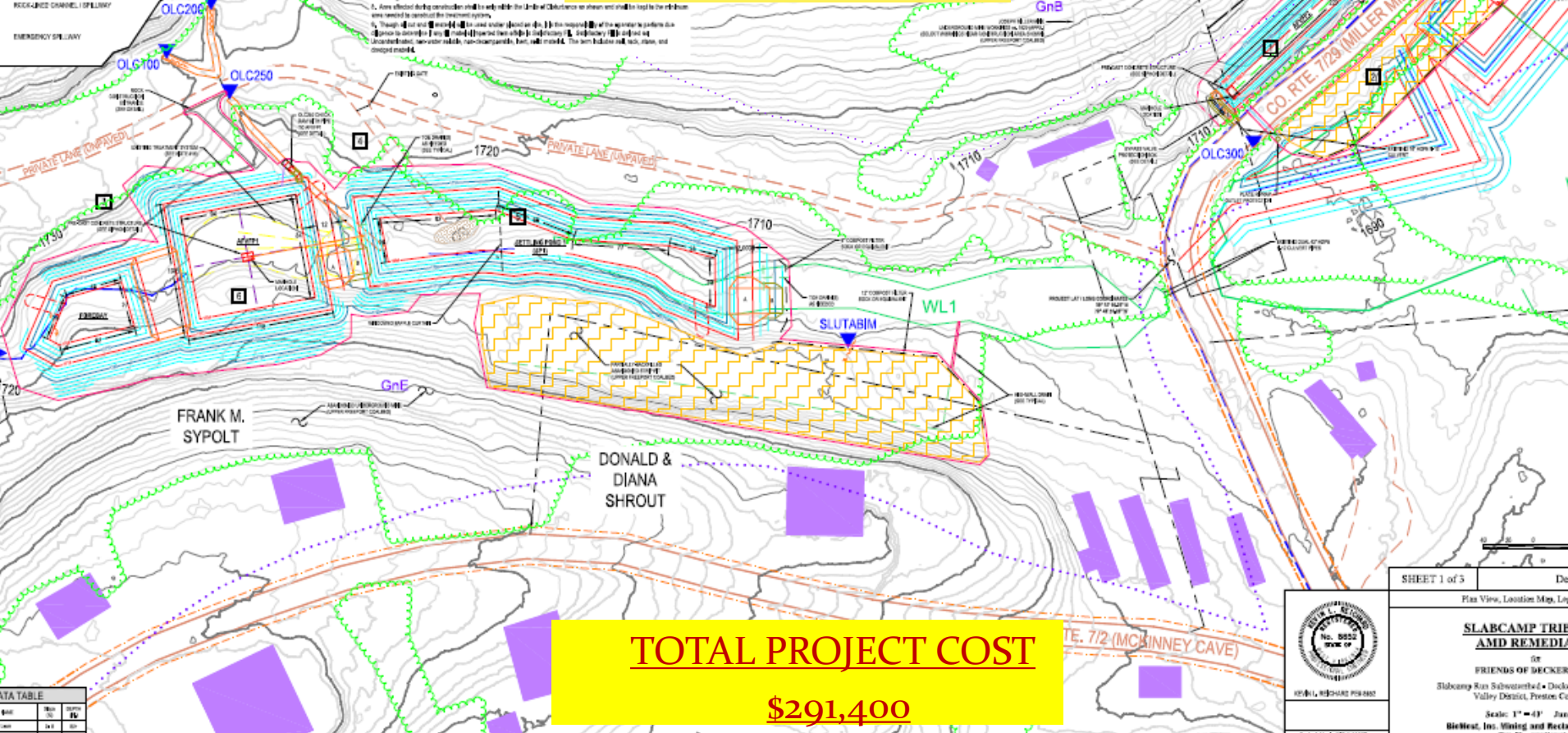
Permanent
 Standard Wood Post-and-Rail
 Post: 4x4 (4x6) (4x8)
 Rail: 2x4 (2x6) (2x8)
 Color: White (Black) (Green)
 Spacing: 10' (12') (15')

DESIGN SUMMARY

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

GENERAL NOTES:

1. All work shall be completed by 11/15/2023. Any work to be completed after 11/15/2023 shall be subject to a 5% per month penalty. The contractor shall be responsible for obtaining all necessary permits and approvals from the appropriate agencies. The contractor shall be responsible for obtaining all necessary permits and approvals from the appropriate agencies. The contractor shall be responsible for obtaining all necessary permits and approvals from the appropriate agencies.
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TOTAL PROJECT COST

\$291,400

SHEET 1 of 5



SLABCAST TRIBUTARY
AND REMEDIATION

OR
FRIENDS OF DECKERS

Slabcast Run Subwatershed & Deckers Valley District, Potosi Co., NY

Scale: 1" = 40'
 Date: 11/15/23
 Drawn By: [Name]

NO.	DATE	BY	DESCRIPTION
1	11/15/23	[Name]	ISSUED FOR PERMIT
2	11/15/23	[Name]	REVISION
3	11/15/23	[Name]	REVISION
4	11/15/23	[Name]	REVISION

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 #860
- 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

Friends of Deckers Creek

Solid Rock Excavating

WV DEP (Martin Christ)

Landowners



Friends of the Cheat

