Passive System Rehabilitation of a High Flow Acidic Coal Mine Discharge

Presenter: Ryan M. Mahony

Additional Authors: T.P. Danehy, D.A. Guy, C.F. Denholm, S.L. Busler, C.A. Neely, M.H. Dunn

Site Location

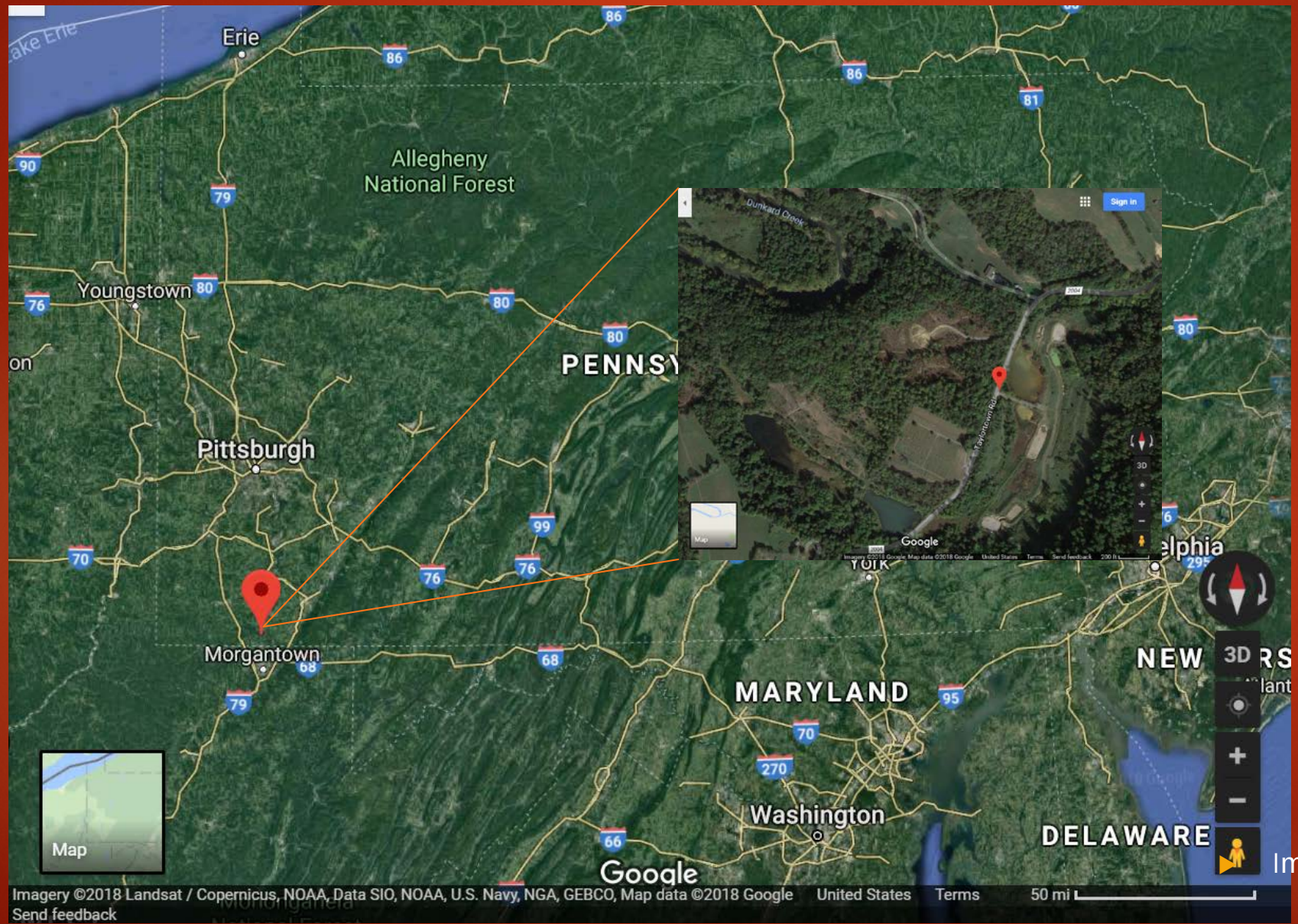


Image credit: maps.google.com

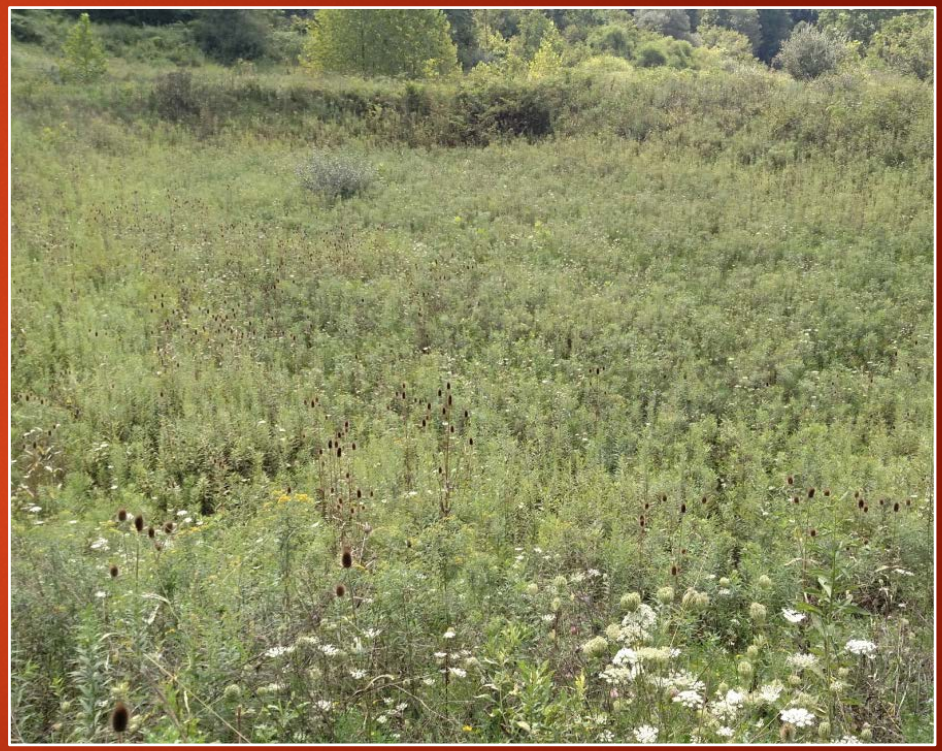
Maiden Passive Treatment System Background

- Constructed 2006 to treat an abandoned acidic coal mine discharge
- Largest passive system in Dunkard Creek Watershed
- Treats 2 mine discharges

Reference: www.datashed.org

Maiden Passive Treatment System Background

- High flow/loading discharge with no maintenance for almost 10 years due to refusal of landowner access from 2006 through 2015
- Land purchase by MEPCO, LLC in 2015
- Maintenance Aug-Nov 2016



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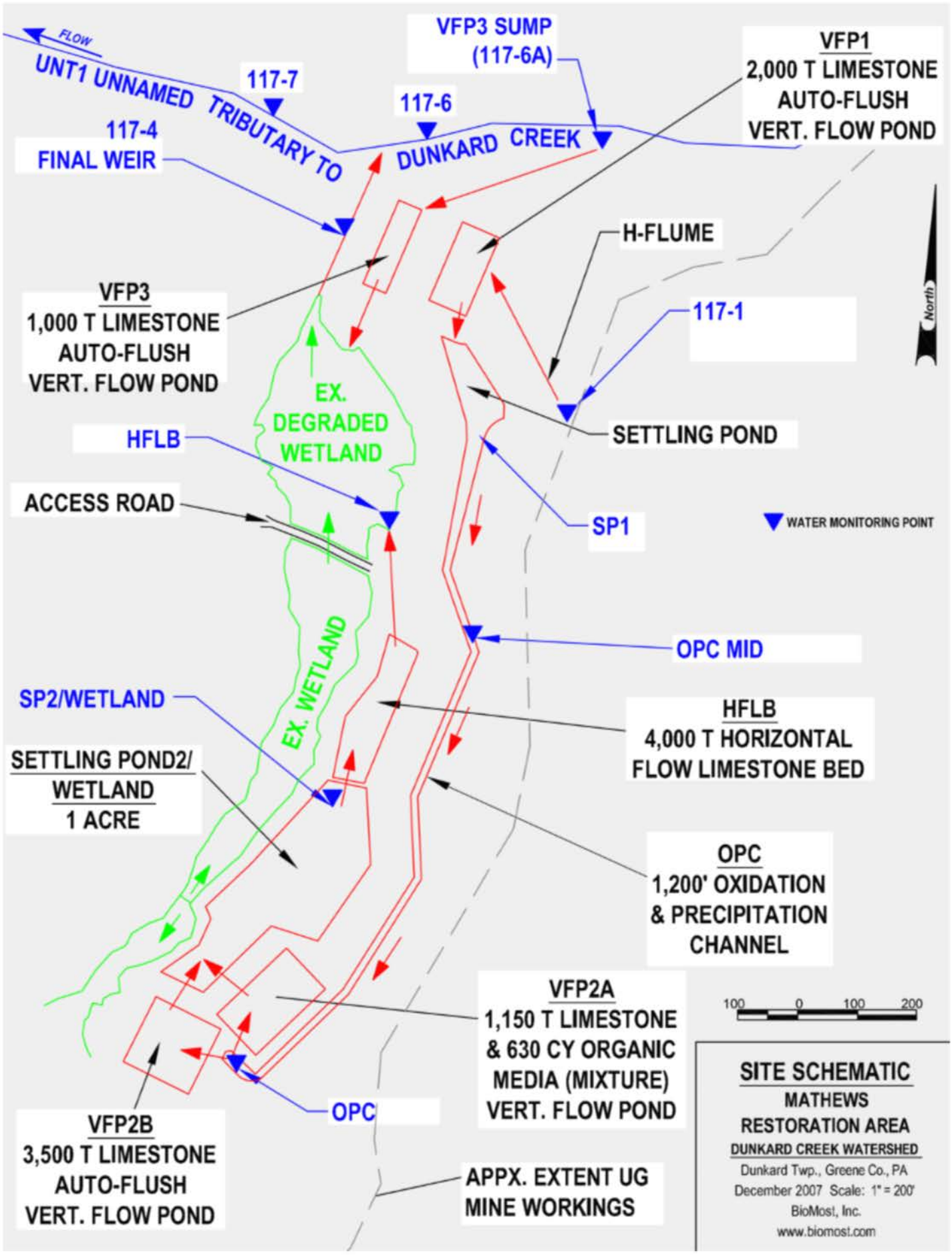

FLOW
UNT1 UNNAMED TRIBUTARY TO
DUNKARD CREEK
117-7
117-6
117-4
FINAL WEIR
VFP3 SUMP
(117-6A)
VFP1
2,000 T LIMESTONE
AUTO-FLUSH
VERT. FLOW POND
H-FLUME
117-1
North
VFP3
1,000 T LIMESTONE
AUTO-FLUSH
VERT. FLOW POND
EX.
DEGRADED
WETLAND
HFLB
ACCESS ROAD
SETTLING POND
SP1
WATER MONITORING POINT
OPC MID
EX. WETLAND
SP2/WETLAND
HFLB
4,000 T HORIZONTAL
FLOW LIMESTONE BED
SETTLING POND2/
WETLAND
1 ACRE
OPC
1,200' OXIDATION
& PRECIPITATION
CHANNEL
VFP2A
1,150 T LIMESTONE
& 630 CY ORGANIC
MEDIA (MIXTURE)
VERT. FLOW POND
100 0 100 200
OPC
VFP2B
3,500 T LIMESTONE
AUTO-FLUSH
VERT. FLOW POND
APPX. EXTENT UG
MINE WORKINGS
SITE SCHEMATIC
MATHEWS
RESTORATION AREA
DUNKARD CREEK WATERSHED
Dunkard Twp., Greene Co., PA
December 2007 Scale: 1" = 200'
BioMost, Inc.
www.biomost.com

Raw Water Quality Data (Avg)

Sample Point	Flow (gpm)	pH	Acidity (mg/L)	Fe (mg/L)	Mn (mg/L)	Al (mg/L)
117-6A	28.5	2.8	359	26	3.5	28
117-1	321	2.7	354	46	4.2	19

*Each discharge treated by separate set of components within the “system”

Site Challenges

- Flooding of state route due to beaver activity at outlet of system
- HFLB clogged and overgrown with vegetation
- VFP1, VFP2B, & VFP3 siphons not functional
- VFP1, VFP2B, VFP3 stone clogged with Fe precipitates
- SP1/ Oxidation precipitation channel overflowing
- No flow to VFP2A (clogged inlet pipe)
- Underdrain pipes clogged in multiple components

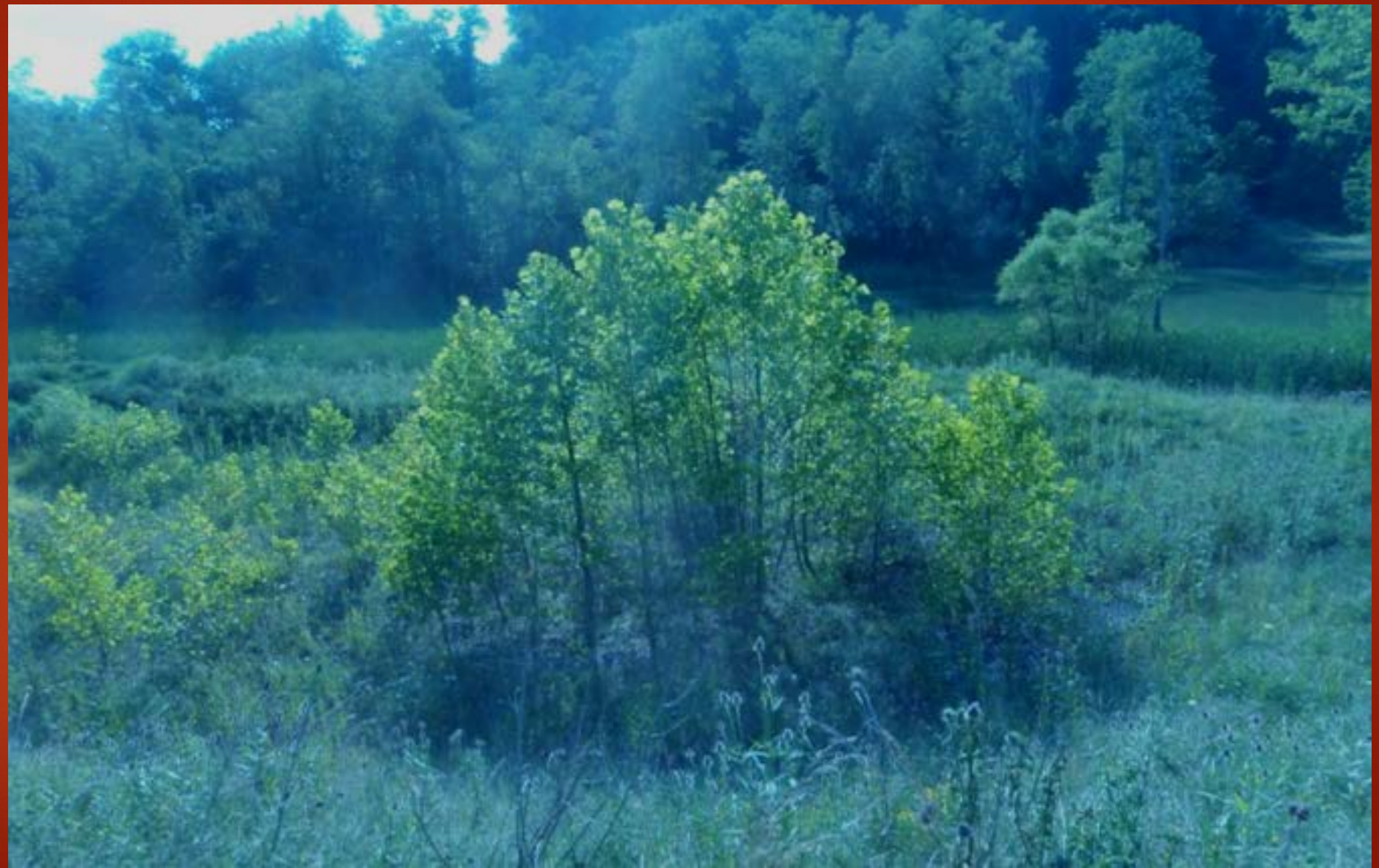
Beaver Issues

- Left: Beaver dam at outlet of oxbow lake located at the system outlet
- Right: Flooding due to beaver dam on state road (August 2015)

Beaver Issues

- Installed dual 24” piping as “beaver proof” system outlet

HFLB Overgrown & Clogged



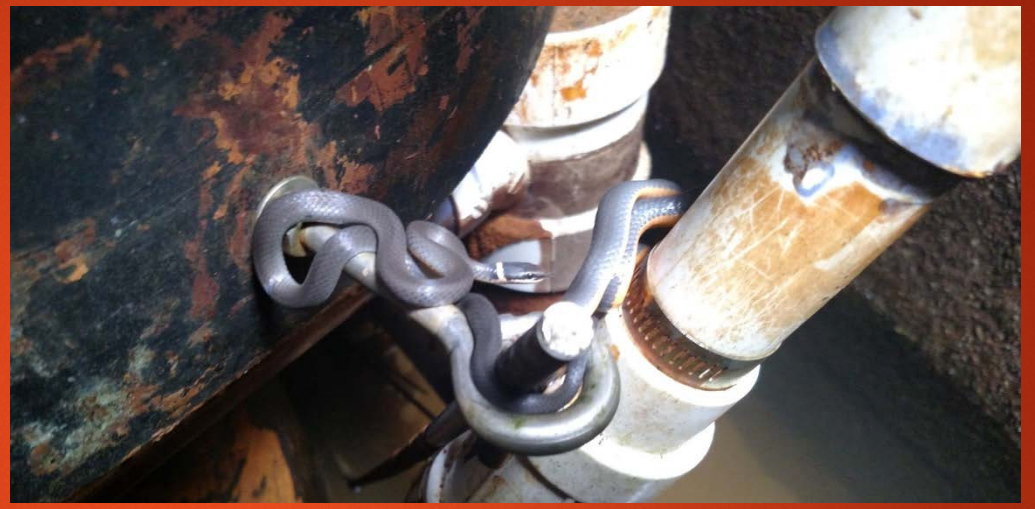
HFLB Maintenance

- HFLB upgraded with infiltration trenches & inlet/outlet pools

VFP2B Siphon Repair

- Siphon trigger damaged by wildlife

VFP2B Siphon Repair

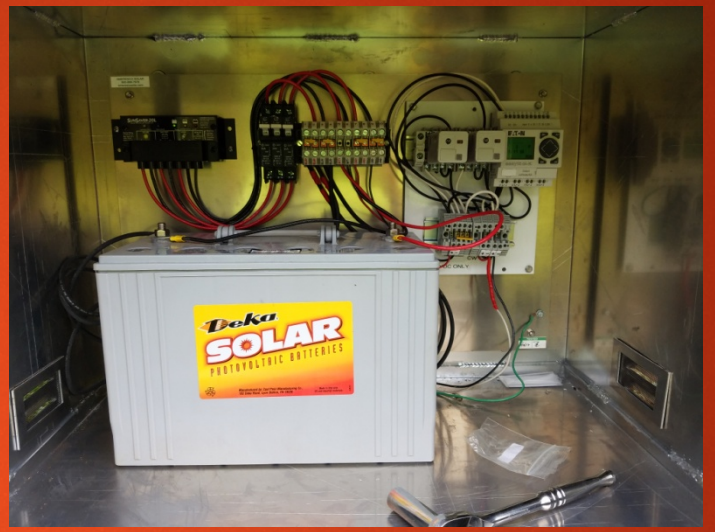


VFP2B Siphon Repair

VFP3 Siphon Repair

- Damaged siphon bell was retrofitted with improved bracing

VFP1 Siphon Replacement



- Solar powered mechanically actuated valve installed to drain VFP1 on set schedule

VFP1 Media Clogged

- Media was clogged in VFP1 causing all raw water to short circuit pond

VFP1 Media Cleaning

- Iron precipitates had completely filled void space within the pond

VFP1 Media Cleaning

- Excavator and 3” pump with 2” firehose attachment used to wash stone

VFP1 Underdrain Replacement

- Perforated 8” HDPE pipe with caps used to create more durable underdrain

VFP3 Media Clogged

- All flow bypassed treatment through emergency spillway

VFP3 Media Cleaning

- Limestone was cleaned and underdrain was repaired and kept in place

Channel Retrofit

- VFP2A & VFP2B “combined” with VFP2B as “high flow use only” component

VFP2A Offline

- System component offline for almost 10 years with no treatment

VFP2A Stirred

- Media was “fluffed” to improve permeability

VFP2A Adjustments

- VFP2A outlet risers were adjusted due to variable site conditions and effluent quality goals

VFP2A Stirred (Again)

- High quality treatment from media but less than expected flow prompted a second media stir

VFP2B Stirred

- Media stirred, HDPE underdrain installed, infiltration trench installed

General Maintenance

Settling pond 8” bypass valve replacement and removal of E&S controls left in place from initial system construction

Post Maintenance Water Quality

Sample Point	Flow (GPM)	pH (field)	Acidity (mg/L)	Alkalinity (mg/L)	Fe (mg/L)	Mn (mg/L)	Al (mg/L)
117-1 (Avg) n=32	321	2.88	354	NM	46	4	19
Effluent (post rehab avg) n=6	327	5.2	54.9	36	1.3	1.6	5.6

*Note 3/5/2017 sampling was a flow 0f 689 gpm, pH 3.52, acidity 124(over double system design flow) and is included in effluent average

*Data available at www.datashed.org

Project Accomplishments

- Cleaned 10,500 tons of limestone (VFP1, VFP2B, VFP3, HFLB)
- Installed 600 feet of HDPE underdrain pipe (VFP1 & VFP2B)
- Rehabilitated 1,300 CY of treatment media (VFP2A)
- Installed 150'-long channel to by-pass clogged culvert
- Installed flow-balancing channel between VFP2A & VFP2B
- Installed pipe outlet control on VFP2B
- Repaired VFP2B siphon mechanism that was damaged by wildlife
- Repaired VFP3 siphon worn by almost a decade of use
- Installed dual 24" piping as "beaver proof" system outlet
- Replaced 8" by-pass valve (SP1)
- Reconfigured HFLB to include inlet and outlet pools and infiltration trenches
- Installed solar powered valve actuator at VFP1

What Next?

- Plans to retrofit VFP2B as a mixed media component
- Continued stirring of limestone to maintain media permeability
- Install perforated riser pipe at HFLB outlet

Project Partners

- Foundation for Pennsylvania Watersheds
- Appalachian Stewardship Fund
- Western PA Coalition for Abandoned Mine Reclamation/PADEP
- SRI Operation & Maintenance Technical Assistance Grant (Growing Greener Funded)
- AMDRI
- MEPCO, LLC (property acquisition for site access + on-going water monitoring as part of AMDRI Dunkard Creek Watershed Management Plan)
- Stream Restoration Incorporated
- BioMost, Inc.

Questions?